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ELECTRICAL MEASUREMENTS.

ALTHOUGH many attempts have been made to devise simple forms of apparatus for measuring electromotive forces, current strengths, and resistances, in electric light and other trials, yet it cannot be said that any instruments of a really reliable character have yet been brought out. The electric light engineer requires "some simple form of instrument, not liable to get out of order and which can be used by any intelligent workman, &c." We have little hesitation in saying that the engineer will have to wait for a very long time before he will get his requirement satisfied. Simplicity is undoubtedly much to be desired, but if it is obtained at the expense of accuracy, it may be bought dearly; and we think that the numerous attempts which have been made to satisfy the demand have resulted in the production of instruments which, though accurate when first made and when used under particular conditions, become utterly unreliable after the lapse of time and when used for the measurement of quantities, which differ considerably from one another. The commonest form of apparatus for current measurement is a galvanometer with a polarised needle; now, such an instrument is practically of little value except for measuring currents of a particular strength. If the deflection obtained is midway between zero and 90°, the indications (if the instrument is in proper order) can be relied upon to about an accuracy of say 2 per cent., but if the deflections are of a low or of a high value, then the results obtained become almost valueless for comparisons. Another obvious source of error is that which must result from the inducing magnets losing their power, a loss which inevitably takes place and which no amount of care will prevent. To obtain accurate results the "constant" of every instrument ought to be frequently taken; this, we believe, is very seldom done.

The importance of "accuracy" in measurements of any kind cannot be over-estimated, especially when comparisons have to be made in which a slight error may turn the balance in one direction or the other.

An electric light engineer would probably be somewhat surprised if he were asked to weigh accurately a few grains of dust in a weighing machine suitable for weighing a ton of coals, yet he frequently in his electrical measurements endeavours to obtain results with apparatus which are quite as unsuited for the purpose as would be the weighing machine for ascertaining the weight of the dust. The designer of the electrical instruments is perhaps more to blame in the matter than is the user of the same, inasmuch as he does not indicate on the apparatus what its actual capabilities are, or on the other hand, he claims more for the instrument than ought to be allowed.

Even supposing accurate and simple means of measuring were at the disposal of the engineer, it is doubtful whether the results obtained could be of much value when the actual and known sources of error are glossed over, as is often the case. In a recent exhibition of a well known electric lighting system we have the following intelligible and reliable measurement given. Speaking of the resistance of the machine the report says:—"The internal resistance is ·005, which would remain *almost constant*, for as the resistance of the helix rises on account of heating the resistance due to the *oil on the collectors* would fall." Again, in a recent paper read before the British Association, we have an account of some experiments on changes of resistance, in which the metals in which these changes took place formed a mere fraction of the total resistances measured, yet certain scientific conclusions were drawn from the results obtained, the reliability of which the unconscious author seems to have no doubt. When we continually find cases similar to those cited above, the value of the conclusions drawn from the trials of electrical apparatus, which are continually being made, becomes very questionable.

PHILIPP REIS—INVENTOR OF THE TELEPHONE.

ALL readers of recent numbers of the ELECTRICAL REVIEW are aware that Prof. Silvanus Thompson has lately compiled a biographical sketch of the late Philipp Reis, and, that he has collected together documentary evidence of such a nature as to constitute, in the opinions of many persons, including the author, complete proofs that Reis was the inventor of a practical speaking telephone. We ourselves did not feel convinced that Prof. Thompson had succeeded, and, in our review of his production* we endeavoured to show that the author had mistaken or placed a wrong construction on much of his so-called evidence. That we are not alone in the attitude we felt compelled to take, is shown by a long and exhaustive review of Prof. Thompson's work in *Science* of the 5th inst. Those in any way interested in telephony, will, we feel sure, agree that we need not offer any apology for bringing the bulk of this article before their notice.

The reviewer commences with a brief exposition of the contents of the book, and then goes on to say:—

"Had the efforts of the author been directed to the presentation of these things as matters of history merely, the book might be regarded as a valuable and interesting summary of facts relating to an important invention, and would demand but a brief notice here; but a cursory examination of it is sufficient to show that the author has failed to maintain that judicial attitude of mind which is indispensable to the just and impartial record of historic verities. His book is throughout a laboured special pleading, with the attempt to prove that Reis's invention not only anticipated, but actually embodied, the essential features of the present telephonic apparatus.

"It has been generally accepted as true, that Reis designed his transmitter to act as a contact-breaker, which should open and close the circuit once for each vibration produced by the sound to be transmitted. The support for this view is found not only in the repeated statements of Reis himself, but also in the

* See ELECTRICAL REVIEW for August 4th, 1883.

construction of the apparatus. Reis says, in his own description of his transmitter (p. 56), 'each sound-wave effects an opening and a closing of the current;' and again, in his letter to Mr. Ladd (p. 84), 'If a person sing at the station, A, in the tube, *x*, the vibrations of air will pass into the box and move the membrane above; thereby the platina foot, *c*, of the movable angle will be lifted up and will thus open the stream at every condensation of air in the box. The stream will be re-established at every rarefaction. For in this manner the steel axis at station, B, will be magnetic once for every full vibration.'

"With these and other most distinct statements of Reis, as to the intention and action of his apparatus, before him, Prof. Thompson, nevertheless, asserts that it was never designed to break the circuit. Further, the author maintains that the combination of an adjusting screw with a spring shows that Reis intended the platinum contact-piece to have a following motion, so as to make a contact with varying pressure. He says on p. 133, 'By employing these following-springs, he introduced, in fact the element of *elasticity* into his interrupter; and clearly he introduced it for the purpose of avoiding abrupt breaking of the contact.' If we examine the illustrations of the different forms of the transmitting apparatus, we shall see that this device was employed for a very different purpose. In the earliest form, the screw presses the spring *away* from the membrane, and, when the latter recedes in its vibration, the spring carrying the platinum point is prevented by the screw from following it—an arrangement that tends to prevent, and was designed to prevent, a following contact, and insures a breaking of the circuit when the distance of the point is properly adjusted. The same is the case with a second form of transmitter. In another form the screw is present, and works against a spring; but the screw passes through a stout and firm piece of metal, and presses the spring which carries the contact-piece forward, that is, towards the membrane, thus giving it a rigid support. The spring serves merely to push back the contact-piece when the screw is reversed, a very simple and common mechanical device for giving motion in opposition to the thrust of a screw. In the lever form, the screw is arranged in a similar manner, so as to regulate the distance of the contact-piece from the end of the lever most remote from the membrane. In all these instruments the screw acting upon the spring is expressly contrived to facilitate such an adjustment as will insure the breaking of contact under the impact of the sound-waves. Its function is related to the tension and elasticity of the membrane, to make a pressure so light in any case, that the vibrations should be able, without fail, to separate the contact-pieces.

"To say, as Prof. Thompson repeatedly does, that Reis employed his mechanism with the express intention of producing a variable current by the change of contact-resistance, and that he consciously and purposely utilized this principle—at that time hardly recognized anywhere, and of which the practical application was not discovered till several years later—is a gross misrepresentation, and an utter perversion of the facts. Reis did not know, and could not know, that the strength of a current could be controlled by the varying pressure of the conducting-surfaces between which it passes. Nowhere in his writings, whether in his description of the instruments, or in the prospectus issued with them, or in his letter to Mr. Ladd—nor in the article of Prof. Böttger and the report of Von Legat, is there the remotest suggestion that the transmitter acted, or was intended to act, otherwise than by breaking the circuit. Nor is anything of the kind to be found in any of the publications of the day, relating to this matter. With the knowledge which we now possess, of the varying resistance of pressure-contacts, it is indeed easy, by a slight modification, to cause the contact-pieces to vary the current by change of pressure, and thus reproduce the vibration-form with approximate accuracy. But to do this, it is necessary to prevent them from separating so as to break contact and interrupt the current. Such a modification, however slight it may be, totally changes the function of the contact-pieces, and amounts to a radical transformation of the apparatus. It is the very thing Reis studiously sought to prevent.

"The idea of causing the motions in the receiver to have the same vibration-form as those in the transmitter originated with Bell, as did the method of securing this correspondence, which is indispensable to the reproduction of spoken words, by the use of an undulatory current. Says Sir William Thomson (TEL. JOUR. AND ELEC. REV., vol. v., p. 293), 'Mr. Graham Bell conceived the idea—the wholly novel and original idea—of giving continuity to the shocks, and of producing currents which would be in simple proportion to the motion of the air produced by the voice, and of reproducing that effect at the remote end of a telegraphic wire.' The author of this book will scarcely have the hardihood to assert that his illustrious countryman, one of the greatest masters in electrical science, uttered these words in ignorance of a thing so well known as Reis's telephone.

"There is good evidence in the later writings and advertisements of Reis that he had come to the concluclusion that the faithful reproduction of the complex motions which occur in articulate speech was impossible, and that he had silently abandoned the idea of reproducing speech. A further proof of this is found in the addition of the telegraphic signal apparatus to the later forms of the instrument to enable the experimenters to communicate with each other. Prof. Thompson's argument that the Morse signal apparatus, if intended for verbal communication, should have been reversed, meets the facts but half-way; for the complete telephonic installation required a transmitter and a receiver at each end of the wire, so that the Morse signals could be sent in either direction with the same facility as the telephonic. Moreover, as if to prevent any possible question as to its use, Reis himself expressly says that the Morse apparatus is for the purpose of enabling the operators to communicate with each other; and, in the prospectus issued with the instruments, he describes a special alphabet, which he had devised to enable words to be spelled out. If these could be transmitted telephonically why take this unnecessary trouble? This very provision is a most emphatic testimony that Reis at this time had become convinced that the apparatus as a transmitter of speech was a failure, and that, his original idea having proved impracticable, he had contented himself with sending musical tones.

"Respecting the word 'tunes,' used by Reis, the author remarks, in a foot-note to p. 81, 'This word, as the context and ending of the paragraph shows, should have been written *tones*. The letter, written in English by Reis himself, is wonderfully free from inaccuracies of composition; the slip here noted being a most pardonable one, since the plural of the German *ton* is *tönen*, the very pronunciation of which would account for the confusion in the mind of one unaccustomed to write in English.' The resemblance of *tönen* to *tunes* is not so remarkably close that it would be likely to mislead one whose knowledge of English is such as Reis shows himself in this letter to possess. The author does not attempt the explanation of the words 'singing' and 'sing' in the same letter. It is surprising that he should have allowed these words to pass unnoticed, for it was vital to his argument to prove that Reis mistook them for 'speaking' and 'speak.' The resemblance is about as close as in the other case, but in neither is the explanation likely to be admitted by the unprejudiced reader.

"In taking himself back to the time of Reis's telephone the author has failed to identify himself with the conditions of that time, and to leave behind him the subsequent acquisitions of science. As an illustration of the mental disposition resulting from this, the following sentence from the author's preface may serve:—'The testimony now adduced as to the aim of Philipp Reis's invention, and the measure of success which he himself attained, is such, in the author's opinion, and in the opinion, he trusts, of all right-

thinking persons, to place beyond cavil the rightfulness of the claim which Reis himself put forward of being the inventor of the telephone.' But did anyone ever dispute this claim during his life? and has the author forgotten that no possible basis for a rival claim existed until more than two years after Reis's death?—unless we except the suggestions of Bourseul, in 1854, which, while they certainly did anticipate the general idea of Reis's invention, were never carried to the stage of experiment, and were never set up in opposition to him, unless it has been done recently. The author can hardly have been ignorant of these suggestions; but, if not, he has carefully refrained from mentioning them. Reis never claimed that no new principle could ever be discovered which would enable the ends he sought to be attained in a different way, and more perfectly. His first article upon the subject ends with these words: 'There may probably remain much more yet to be done for the utilisation of the telephone in practice. For physics, however, it has already sufficient interest in that it has opened out a new field of labour.' And Von Legat closes his report with this remark: 'There remains no doubt that, before expecting a practical utilisation with serviceable results, that which has been spoken of will require still considerable improvement, and, in particular, mechanical science must complete the apparatus to be used.'

"The chief aim of the book is clearly this—to endeavour, in direct opposition to the facts, to establish the untenable proposition that the Reis transmitter was designedly contrived by him to vary the contact-resistance by pressure, giving it a microphonic action, failure to accomplish which is fatal to its success in conveying spoken words. Prof. Thompson has not always been of this opinion, and in another place he has given a correct account of the relation of Reis's invention to that of Bell. In his 'Elementary Lessons in Electricity and Magnetism,' published in 1881, we find, on pp. 405 and 406, these words: 'The first attempt to transmit sounds electrically was made in 1852 (misprint for 1862) by Reis, who succeeded in conveying musical tones by an imperfect telephone. The transmitting part of Reis's telephone consisted of a battery and a contact-breaker, the latter being formed of a stretched membrane, capable of taking up sonorous vibrations, and having attached to it a thin strip of platinum, which, as it vibrated, beat to and fro against the tip of a platinum wire, so making and breaking contact. . . . Reis also transmitted speech with this instrument, but very imperfectly, for the tones of speech cannot be transmitted by abrupt interruptions of the current. . . . . In 1876 Graham Bell invented the articulating telephone. In this instrument the speaker talks to an elastic disc of thin sheet-iron, which vibrates and transmits its every movement electrically to a similar disc in a similar telephone at a distant station, causing it to vibrate in an identical manner, and therefore to emit identical sounds.' Here we have Reis spoken of as inventing '*an* imperfect telephone,' while Bell invented '*the* articulating telephone.' Reis's instrument was 'a contact-breaker,' and conveyed 'musical tones.' Reis's instrument transmitted speech 'very imperfectly,' and there is not the slightest suggestion of microphonic action in the transmitter. Yet, two years later, we have statements diametrically opposed to these.

"The least that can be said of such varying and contradictory evidence is, that it totally destroys the credibility of the witness, and nullifies his claim to be accepted as a scientific authority, unless good reason is shown for the different opinion. The documents quoted in the book give no substantial reason for this change of ground, as they add very little of any importance to what was already generally known. The motive for the later opinions may be more intelligibly traced in the following items, which will be found in the TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW, vol. xii., p. 72, Jan., 1883, and p. 317, April 14, 1883, in the list of English patents:—'2578. Telephonic instruments. SILVANUS P. THOMPSON. Dated May 31. 6d. This invention relates to telephonic instruments, and chiefly to improvements in receivers of a well-known form or type, invented by Philipp Reis.' '3803. Improvements in telephonic apparatus. SILVANUS P. THOMPSON. Dated August 9. 6d. Relates to telephonic transmitters based upon the principle discovered by Philipp Reis in 1861, namely, that of employing current-regulators actuated, either directly or indirectly, by the sound-waves produced by the voice. By the term "'current-regulator,'" the inventor means a device similar to that employed by Reis, wherein a loose contact between two parts of a circuit (in which are included a battery and a telephonic receiver) offers greater or less resistance to the flow of the electric current, the degree of intimacy of contact between the conducting-pieces being altered by the vibrations of the voice.'

"For a contrast of colours, we may put side by side with these sentences the following, from the preface to the book now under consideration: 'To set forth the history of this long-neglected inventor and of his instrument, and to establish upon its own merits, without special pleading, and without partiality, the nature of that much-misunderstood and much-abused invention, has been the aim of the writer. . . . He has nothing to gain by making Reis's invention appear either better or worse than it really was.'

"Further comment upon the value of such testimony as is contained in this book is superfluous. What Reis accomplished, and what he failed to do, are now familiar matters of history. His well-earned fame can only suffer from such mis-statement of facts, and the unjust exaggeration of his actual achievements."

A USE FOR THE STEAM-ENGINE INDICATOR.

AT a meeting of the Franklin Institute, on the 19th ult., Mr. Robert Grimshaw, M.E., read a short paper, published in the journal of the institute, on the "Steam-engine indicator as a detector of lost motion." We think this article will be found interesting to many engineers and we therefore reproduce it and the drawing illustrating the subject. The particular application of the indicator here mentioned has not, Mr. Grimshaw believes, been heretofore made public. He says:—"A very intelligent engineer, Mr. Gilman W. Brown, of Boston, had put in his hands for remedy a most pronounced case of pounding in a high-speed engine. This machine thumped at high speeds and at slow speeds; at high pressures and at low pressures; at early and late cut-offs, and under apparently all imaginable conditions of lead and compression. Wherever it was attempted to locate the thump, it appeared somewhere else; or, at least, was not where suspected.

"There evidently was only one way to find out where that thump was: to make it record itself—something which had never before been done, but which was now to be effected.

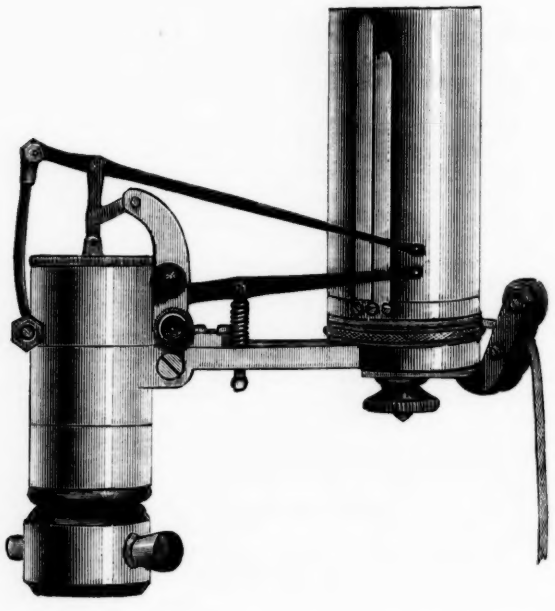
"If the time, and the position in the stroke, at which the thump came in, could in some way be graphically recorded, the problem would be a long way towards solution.

"Now, if an indicator can pick out the existence, and locate the time, of lost motion in a valve, why not in that of a crank-pin, or a cross-head pin or a main bearing?

"It is evident that whatever trace the tell-tale instrument should make of lost motion, outside of the valves, should not interfere with its record of the valve functions; and the natural deduction was that there must be another trace, necessitating another marking-point, in no wise connected with the indicator-piston, nor influenced by the steam-pressure.

"To effect this, there was added to a 'Crosby-Brown' indicator a second multiplying-lever, having a vertical motion only, and bearing a pencil making a trace underneath, and parallel to, the atmospheric

and vacuum lines of the usual 'diagram.' This lever was pivoted to a little standard on the connecting-piece of the instrument, and the pencil position was adjustable in height by a spring and screw, the latter formed on a light rod passing through the connecting-piece. Vertical motion of this rod caused the pencil to vibrate vertically. If the rod was kept at a constant height, the pencil would trace a horizontal line partly around the paper cylinder; but any pull on the rod would make a jog in the tracing.



"The main bearing being slacked up, a vertical metal lever was pivoted to the bed-plate, so as to bear against the far side of the main-shaft (assumed to be truly cylindrical, and tested for this purpose, beforehand). The upper end of this lever was connected by a wire, or inelastic cord, passing around a guide-pulley, to the lower end of the vertical rod on the lost-motion lever of the indicator, and all slack taken up, and held out by the spring on the vertical rod.

"It is evident that if the main-shaft has any horizontal movement, it will cause horizontal vibration of the free end of the lever bearing against it, and thus tighten or slacken the cord and produce a vertical movement of the lost-motion lever on the indicator. This will cause a jog, either below or above, in the supplementary horizontal line representing the cross-head path, and will indicate, beyond all question, where the lost motion commences, how long it lasts, in which direction it is from the normal, and when and where it stops.

"By the aid of this rig, its inventor effectually cured the hitherto incorrigible engine."

New Land Lines in Ecuador.—General Alfaro, of Ecuador, has made a contract with Mr. M. J. Kelly, an American, for the construction of about 300 miles of telegraph lines, which are to connect Bahia, Manta, Esmeraldas, and other important towns in the lower provinces with Guayaquil and the cable lines of the Central and South American Telegraph Company.

Tampering with Racing Telegrams.—At the Manchester City Police Court on Friday of last week, Henry Hulme, compositor; William Brittain, newspaper publisher; John Edwin Gartside and Septimus Lockwood Lamb, telegraph clerks, were committed for trial at the assizes, Gartside and Lamb on a charge of making known the contents of certain telegrams, and Hulme and Britain of conspiring to obtain certain telegrams, the property of the Postmaster-General.

REVIEWS.

*Die Verkehr's Telegraphie der Gegenwart mit besonderer Berücksichtigung der Praxis.** By J. SACK, Imperial Inspector of Telegraphs, Vienna, Pesth, and Leipzig. A. Hartleben.

This abundantly illustrated work forms the fifth volume of the Electro-technical Library issued by the well-known publishing firm of A. Hartleben.

The author opens his subject with a short sketch of the origin and development of telegraphic intercourse in the widest sense of the word. He mentions the beacon-fires of antiquity and of the middle ages, of which, by the way, evidence still remains on many eminences in the north of England and in Scotland. Then followed the semaphore, long in use between the Admiralty and Portsmouth, and between Paris and several important points on the French frontiers. This system, in which messages were sent by the combined movements of wooden arms affixed to a lofty mast, seems, according to the author, to have been first proposed by Robert Hooke in 1684. It was overlooked, however, for another century, when it received, from Miot, the name of "telegraphy." Into the consideration of acoustic and optic telegraphy, however, the author does not here enter, referring the reader to Vol. VI. of the present series for the telephone, to Vol. XII. for railway signals, and to Vol. XV. for mirror telegraphy as now practised in war and at sea.

The first attempts at electric telegraphy were made in 1746, frictional electricity being of course utilised. In 1808, Sömmering made the first attempt at the use of galvanic electricity for this purpose. Œrsted's discovery of the deflection of the magnetic needle, made in 1820, was applied by Ampère to telegraphic purposes. This attempt, imperfect at first, in as far as a separate wire was used for every letter of the alphabet, paved the way to the present system of electro telegraphy. An important step was taken in 1832 by Cannstadt, who devised an apparatus for producing all the letters of the alphabet by the movements of a magnetic needle, and dispensed with all the wires except two. According to the author, the first actual use of this simplified needle-apparatus is due to Gauss and Weber, of Göttingen, who in 1833 laid down a telegraph line between the Observatory and the Physical Cabinet of the University. In 1837 Steinheil succeeded in dispensing with the return wire in a telegraph which he erected between the Academy at Munich and the Observatory at Bogenhausen. With this discovery telegraphy upon the large scale was brought within the region of practice.

Of the three points upon which the successful working of a telegraph depends, two—the production of a constant electric power, and its transmission, undiminished, to some distant locality—are respectively discussed in Vols. IV. and XVI. of the "Electrotechnical Library." The third point, the utilisation of the power for the delivery messages—in other words, the various forms of telegraphic apparatus—is considered at length in the volume before us. The author divides telegraphic apparatus into two main classes: those which leave no permanent traces of the messages sent, such as the needle apparatus of Cooke and Wheatstone, and the index apparatus of Davy, and those which leave a permanent record. The latter, including all forms of writing or printing apparatus, are the more numerous and the more important.

All the principal appliances of each class are described at length, their characteristics and their advantages and defects being very fairly and fully explained.

In a concluding chapter there follows a comparison of the principal kinds of apparatus, especially as regards simplicity, durability, and economy of construction, and power of performance. It is conceded that

* The Telegraphic Intercourse of the Present, with Especial Reference to Practice.

for small or middle-sized stations the simple Morse apparatus is preferable, though in the latter it should be combined in case of need with the duplex. For larger stations the apparatus of Hughes is the only one admissible, aided on special occasions by a good automatic system. The Meyer apparatus is recommended for experimental work, in the hope of determining whether it does not admit of improvement.

That a book on such a subject, furnished with more than a hundred illustrations, accurately and clearly drawn, can be got up at so low a price is a proof of the general interest felt in the technical applications of electricity.

The Patents, Designs and Trade Marks' Act, 1883. By JAMES and J. HENRY JOHNSON. London: Longmans, Green & Co., Paternoster Row.

This little book is a reprint of the new Act with explanatory notes and an introduction, pointing out the principal alterations effected by the measure. The reputation of the Messrs. Johnson, who are well known as the authors of the "Patentees Manual"—a fifth edition of which is now in preparation—is a sufficient guarantee that the work before us was needed, and that it will be found useful to inventors and intending patentees. A well arranged index is included which adds to the value of Messrs. Johnson's production, and its low price brings it within the reach of all.

Electrical Measurement and the Galvanometer; its Construction and Uses. By P. D. LOCKWOOD. Published by J. H. Bunnell & Co., 112, Liberty Street, New York.

The title of this work would lead one to suppose that its aim was to set forth the principles af electrical measurement in a general manner, but a careful perusal of the book must, we think, convince the reader that its primary object is to advertise a special form of galvanometer, resistance coils, and Wheatstone bridge, introduced by Messrs. J. H. Bunnell & Co., which we are informed "combines great convenience and efficiency in work, and excellency of finish, with prices which are within the reach of every one." As far as we can judge the apparatus described seems well adapted for the purpose for which it was designed, whilst the first portion of the book, which leads up to the use of the apparatus in question, gives very lucidly some of the principles involved in electrical measurement.

THE WORKING OF A TURBINE.

WHEN the experiments of the Municipal Committee of Grenoble on my dynamo-electric machines were finished, it occurred to me* to study the working of the turbine which actuated the generator situated at the Vizille station.

This turbine actuated several sets of gearing, which on ordinary occasions, were used for driving millstones for crushing cement; but these had been removed at the time when the experiments were made by the committee, so that the sets of gearing were turning freely. The last axle of the latter, worked by the turbine, carried a Prony brake, and a large pulley connected by a belt to the pulley of the generator. I slipped off this belt, and making the height of the sluice gate of the turbine equal to about $\frac{1}{3}$ of its maximum height, I placed in the pan of the brake, weights increasing in arithmetical progression, and carefully measured the speed of the brake-axle corresponding to each load. I then changed the height of the sluice gate and recommenced the same experiments. The following tables show the results obtained for increasing the heights of the sluice:—

Designation of experiment.	Load on brake.	Number of revolutions of the brake per minute.		Total work of the turbine in horse-power.
		Measured.	Calculated.	
A	20	147·5	147·5	10·30
	25	139·5	139·7	12·17
	30	132·5	131·8	13·87
	35	,,	124·0	,,
	40	117	116·2	16·33
	45	,,	108·3	,,
	50	100·5	100·5	17·54
B	20	162	162	11·31
	25	153	154·5	13·35
	30	146	147	15·28
	35	138	139·5	16·85
	40	131	132	18·29
	45	124·5	125·5	19·54
	50	116	117	20·24
	55	110	109·5	21·11
	60	102	102	21·36
C	40	144	144	20·10
	50	130	130	22·68
	60	116	116	24·29
D	40	148	148	20·66
	50	136	136	23·73
	60	124	124	25·96

Each experiment lasted ten minutes, during which period the speed remained absolutely constant.

On referring to the column containing the speeds corresponding to the loads, we find that *when the loads on the brake increase in arithmetical progression, the speeds of the turbine decrease also exactly in arithmetical progression.* This law was verified within very wide limits, since the loads varied from 20 to 60 kilogrammes. It follows, therefore, that the law showing the relation between the load on the brake and the speed is very accurately represented by an equation of the first degree expressed thus:

$$\frac{F}{F_0} + \frac{V}{V_0} = 1$$

in which F and V represent the load and the speed of the brake for any experiment whatever, F_0 the load of the brake which measures the force necessary to stop the turbine, and, V_0, on the other hand, the speed which the turbine takes when the brake is quite free. The co-efficients, F_0 and V_0, naturally vary with the height of the sluice. By means of this formula the figures given in the column, showing the number of calculated revolutions, were found. Experiment, A, was made with the sluice at a height which enabled the generator (the brake being quite free) to make 960 revolutions per minute, giving a current of 3 ampères. The receiver, at Grenoble, then developed six-horse power at the brake, whereas the work absorbed by the generator (calculated by interpolation) was eleven horse-power, a result almost identical with that obtained by the committee, by a different method.*

I would remark, in conclusion, that the equation—

$$\frac{F}{F_0} + \frac{V}{V_0} = 1$$

is precisely the one I arrived at, several years ago, for the purpose of showing, in the simplest manner possible, the circumstances of the working of an electric motor with a constant magnetic field, fed by a source of constant electromotive force.

We see that, in experiment, A, an increase of 5 kilogrammes on the load produced a diminution in speed

* M. Marcel Deprez in *La Lumière Electrique.*

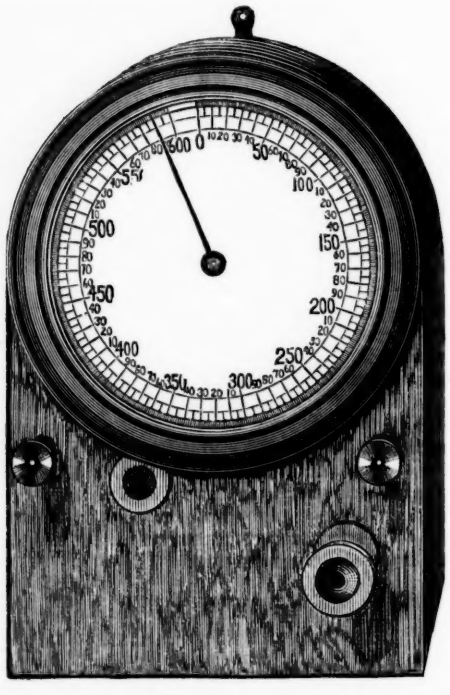
* See ELECTRICAL REVIEW for Oct. 13th, 1883.

of 8 revolutions per minute, no matter what load was on the brake. This enables us to estimate the degree of accuracy obtained by the method employed by the committee, in which the speed was preserved as rigorously as possible at the same value, when the opposition work of the electrical machine was replaced by that of the brake.

AN ELECTRICAL SPEED INDICATOR.

THE importance of maintaining a regular speed in electric light machinery has led to the use of various speed indicators, and several kinds have lately been introduced. They are mostly of a mechanical nature, and are immediately attached to the machinery, some only giving approximate indications.

The subject of the present notice is an electrical apparatus constructed by Mr. W. Groves. The indications are in actual revolutions and the instrument may be used at some distance from the dynamo machines or engines, ordinary insulated wire making the connection between them.



In general principle it is like the "Wheatstone" counter, the parts being modified to suit the purpose. In this counter several dials are used, and the indications may run to millions, extending over a considerable time. In the present apparatus the time is limited to half a minute by a clockwork movement combined with it, and its indications are seen upon one dial. A stop is attached to set the hand to zero, and to complete the electric circuit, the clock breaking it at the half-minute and then stopping.

It requires occasional winding (one winding for 6,000 observations). It will work in any position, and is therefore suited for use on board ship. It can be made in several forms to suit the highest speed dynamo or engine or slower speed machinery.

The transmitting portion of the arrangement may be composed of a magnet, coils, and an armature, which approaches and recedes from the coils, or a set of spring contacts with a battery may be employed.

For small machines, anemometers, electrical motors, &c., a battery is perhaps preferable by reason of the lightness of the spring contacts, but in heavy machines of great power a magneto-transmitter is more desirable.

Such an instrument, within its limits, would be of some value as a permanent arrangement for counting revolutions at any distance from the machinery in motion.

THE GRAMME ELECTRICAL COMPANY OF AMERICA.

WE have received from this company a pamphlet giving a list of its constituent companies and the Letters Patent of the United States owned and controlled by it and by its several members. The constituent companies are seven in number, viz. :—the Brush, Edison, Fuller, Jablochkoff, Thomson-Houston, Weston, and the United States. The patents for apparatus used in connection with electric lighting, held by this great amalgamated concern, number no less than 500. Of these, 180 have Edison's name attached, Weston 88, Brush is responsible for 45, Maxim's name is credited with 42, and the remainder have been taken out by Farmer, Gramme, Houston, Thomson, Jablochkoff, Fuller, Wood, Keith, Waterhouse, Guest, Solignac, and several others. The Gramme Electrical Company notifies that these patents will be enforced against all infringers. It may not be out of place to recapitulate here a portion of an article published in our issue of Sept. 22nd, on the decision of Judge Blatchford which has, so far, rendered the patent for the Gramme machine in America void. We stated that according to American law (U.S. Statutes, 1870, cap. 198, sec. 25), any United States patent taken out for an invention which has been already patented in a foreign country shall expire at the same date with the expiration of the foreign patent. The Gramme machine was patented in France in May, 1870, and in Austria on December 30th, 1870. The patent in America was applied for before the Austrian patent, but was not granted till October 17th, 1871.

As our readers are no doubt aware, the Austrian patent law differs considerably from that of America. The Austrian Gramme patent was granted at first for one year from December 30th, 1870. It was renewed nine times, thus carrying it up to December 30th, 1880, when it was allowed to lapse.

The contention of the plaintiff company was, that the time to be looked to as terminating the American patent was not the actual date of expiration of the Austrian patent, but the time when it would have expired had it been renewed as long as the law permitted. But this view was negatived by the Court, which held (certainly with seeming reason) that the critical date is that of the actual expiration of the patent, which took place on December 30th, 1880, and hence caused the American patent to end at the same time.

A correspondent in the States writes to us, on behalf of the above company, to the effect that the point of the decision is not quite as we set forth. We quote the following from his communication, dated October 6th :—

"The probability is that the U.S. courts will hold, if that question arises (which Blatchford has carefully refrained from considering), that the *term* of the Austrian patent is for *one* year, and any American patent for the same invention will fail at the *end of the term* of *the grant* (not *renewed* term, *which inheres from the grant*), that is, at the end of the first Austrian year.

"That was not the *intention* of the law, probably, but, no doubt, it was not known to Congress *at that time* that there was a *one year* '*term*' anywhere.

"But Blatchford 'skips' all that ; *his* point is—

"Congress *clearly intended* that *an inventor's United States patent should expire with his earliest previously granted equivalent patent.*

"The Austrian *was* an equivalent patent (*being an* '*exclusive privilege*' to make, use, vend, and carrying a right to prohibit and obtain damages).

"*Which it was* NOT !

"Vide secs. 39 and 40 Austrian Statute and sec. 33 of the rules.

"There is 'no wrong without a remedy;' no remedy is provided for *first* infringement, hence no wrong done to inventor, hence a right to make, use, and vend, until stopped by *sentence of civil tribunal*, no *remedy*. Therefore the Judge is wrong."

ON A NEW AND VERY SIMPLE ELECTRO-DYNAMOMETER FOR VERY FEEBLE ALTERNATING CURRENTS.

By M. BELLATI.

THE needle of a galvanometer is replaced by a horizontal piece of soft iron wire, which, when at rest, hangs perpendicular to the magnetic meridian. If the coils of the multiplier form with the meridian an angle of 45°, the wire is temporarily magnetised by currents passed through it, and attempts to place itself at right angles to the plane of the coils, whatever may be the direction of the currents. In an instrument in which, instead of the iron wire, there was suspended a bundle of well-annealed iron wires 0·15 *mm.* in thickness and 17 *mm.* in length, fitted with a mirror and suspended by a thread 10 *cm.* in length in a multiplier 35 *mm.* in width, with a layer 8 *mm.* in thickness of copper wire 0·2 *mm.* in thickness, good results were obtained. In producing telephonic currents by means of the trumpet of Siemens, there was produced a deviation which could not be measured, as the image went beyond the scale. The deviation was perceptible with a gentle voice at the distance of 50 *cm.* from the telephone.—*Wiedemann's Beiblätter.*

THE TELEPHONE.

IN our last issue we briefly drew the attention of our readers to the correspondence going on in the pages of the *Electrical World* as to whether Reis or Bell invented the telephone.

We gave an extract from a letter written by Prof. S. Thompson, and we recounted our own experience with a "needle" receiver.

Mr. Berliner, between whom and Prof. Thompson the controversy is kept up, has communicated to our American contemporary some very able arguments in support of his views. He says—"By what right can Prof. Thompson assert (p. 131 of his book) that *Reis* 'utilised the property of imperfect contacts which alter their resistance,' and that '*this was the essence of his transmitter.*' Does Reis ever mention any such line of thought, or do his contemporaries? Not at all! He neither mentions contact pressure, nor difference of contact area, nor an arc, nor a compressing of the mass, nor heat—not any of the various means which *any* intelligent experimenter would try had he in view to merely *modify* his contact instead of breaking it."

He then goes on to quote Reis, Boettger, and Legat, and shows plainly enough that the Reis transmitter at each condensation and rarefaction of the air *opened* and *closed* the circuit. Further on Mr. Berliner writes:—

"Let me cite Mr. Reis again:—'But at every *closing* of the circuit the atoms of the iron needle lying in the distant spiral are pushed asunder from one another. At the *interruption* of the current the atoms *attempt to regain* their position of equilibrium. . . . But if these actions follow one another more rapidly than the oscillations due to the elasticity of the iron core, then the atoms cannot *travel their entire paths*, the paths travelled over become shorter the more rapidly the *interruptions* occur, and *in proportion to their frequency*.'

"Here, then, is the keynote to Reis's reasoning. He meant to reproduce the sound curves by the *back strokes of the magnetic molecules*. They travel their path more or less *according to the time given them* to do so, and *in proportion to the frequency* of the *interruptions*. Mr. Reis depends on his transmitter to give the exact *number* of interruptions, and he relies on the *comparative slow* demagnetisation of the iron core receiver *to form the curves*.

"Mr. Reis's system, then, consists of interruptions, starting each with a maximum of magnetism, and ending with an independent undulatory trail. In Prof. Bell's system the rise is as gradual as the fall, and both rise *and* fall are entirely dependent on the temporary condition of the transmitter. Reis *meant* to do what we are doing to-day—produce electrical undulations,—but his system was to let the transmitter do one-half and his receiver independently the other half. In the modern system the transmitter does the whole, and the receiver merely follows faithfully."

Mr. Berliner concludes the argumentative portion of his communication with a reference to the Reis receiver. Those who have perused the ELECTRICAL REVIEW for last week are aware of the opinions of Prof. Thompson on this matter, and therefore it is only just that they should see Mr. Berliner's reply.

"I believe the Professor will re-consider his opinion that the Bell receiver, on account of 'so considerable a co-efficient of self-induction,' is inferior as a consonant reproducer to the Reis receiver; and I venture to believe that if the Bell diaphragm is only rigid or thick enough the consonants will come out with as much clearness as in the Reis. But if this 'self-induction' existed at all speech would become less distinct and precise (though weaker) the more Bell receivers are put into the circuit, and this is not the case in practice. Nor does the induction coil, if used without a case and on a short circuit, interfere in the least. But where the circuit is long the discharge of the line becomes slower and distinctness becomes impaired. But the distance we can successfully speak over a line is by far greater with the rapid tension-current of an induction coil than with the slower moving direct battery-current. It is in fact the chief aim of modern telephony to discharge and demagnetise instantly, while, as shown before, Mr. Reis's aim was to *utilise* the *slow* magnetic action for correcting the inadequate performance of his transmitter."

Mr. Berliner complains of the vein of unfairness and partiality against Bell, which, he thinks, runs through Prof. Thompson's book, a review of which, from an American source, will be found in our other columns.

OVERHEAD WIRES.

OUR attention has been called to a case which came before the Wandsworth magistrates last week, where Mr. Paget proceeded with the 17 summonses which had been taken out at the instance of the Postmaster-General against the Wandsworth Board of Works, who refused to grant permission for the erection of posts and overhead wires in certain districts. The proceedings were taken under the Telegraph Act of 1878, and were the first in which a magistrate had been called upon to decide a dispute between the Postmaster and a local board. The Wandsworth Board objected to overhead wires, and wished them to be carried under ground. On the other side, there was an objection to place the wires under ground on account of the expense. Mr. Paget, at the conclusion of the evidence, thought that between two public bodies, in the interests of the public at large, an arrangement might be made as to where the poles should be placed, and the case amicably settled. It seemed to him that he must decide in favour of the Postmaster-General, the additional expense of placing the wires under ground being so great, besides interfering with the strange anatomy of pipes which was to be seen on any ground being opened. Mr. Lane addressed the Bench, and pressed upon the magistrate to consider that the additional expense was far outweighed by the danger of increasing the number of wires. He thought the Board were justified in coming to the Court and asking that the danger might not be increased. The summonses were then adjourned for an arrangement, Mr. Paget stating that if he were pressed for a decision he should report in favour of the Postmaster-General.

From this case, and also from the report of a joint committee of the parishes of St. George's, St. James's, and St. Marylebone, which we give in full, it would appear that action is now being taken by the various vestries and local authorities of the metropolis, to have the question of overhead wires placed on some more definite basis than apparently at present exists. Of the

advisability of there being some legislation on the vexed point there can be no doubt, but at the same time it is a matter demanding the most careful consideration. If it be in the power of a vestryman who probably, and almost certainly, will know nothing of electrical science, to get up and decide that certain wires must not go over the parish which he represents, then decidedly telegraphic and telephonic companies will be exposed to serious inconveniences, which will also be equally felt by the general public.

Not long since we devoted some of our space to the consideration of underground wires, and the difficulties in transmitting messages inherent with their use, and we expressed an opinion that if the local authorities decided to remove overhead wires, or at any rate to prevent their further extension, a remedy would eventually be found to the present inconveniences attending the use of underground wires. It seems to us, however, that that which the vestries are called upon to decide is very much of the nature which a surveyor is called upon to answer in the case of buildings.

There can be no doubt that neither the General Post Office authorities nor any of the telephone or telegraph companies have any right whatever to run wires over private property without obtaining the consent of the owners of such property, and this is a point frequently brought forward by the vestries in their endeavours to prevent overhouse wires; but in our experience private individuals are well able to take care of their own interests, and we think that the records of many of the telephone companies would make it very clear that this is the case, and would show what might be termed the extortionate charges that are frequently made when private individuals find that they have such companies in their power. On this point, therefore, we think the authorities and vestries can well leave the public to take care of themselves.

We commend this subject to the notice of our readers, and again invite discussion.

Parish of St. George's, Hanover Square,
Board Room, Mount Street,
13th August, 1883.

OVERHEAD WIRES.

Sir,—By direction of the vestry of this parish I forward herewith copy of a report of a committee of the vestry who were present at the deputation to the President of the Local Government Board, on the 25th June, on the subject of Overhead Wires, together with the following resolutions thereon, which have been unanimously adopted by the vestry, viz.:—

1. That this vestry is always willing to execute its lawful function of abating annoyances in the streets, but having no control over the laying of wires high above the streets, this vestry declines to accept any responsibility for damage resulting from such wires.

2. That this vestry regrets that Her Majesty's Government has declined to take any steps for placing the dangerous practice of laying wires over the streets under the control of some responsible public authority.

3. That copies of the report now presented and of the foregoing resolutions be forwarded to the Local Government Board, the Corporation of London, the Metropolitan Board of Works, and to the several vestries and district boards of the Metropolis.

I am, Sir,
Your obedient Servant,
J. H. SMITH,
Vestry Clerk.

Report of the Committee appointed to form Deputation to Local Government Board as to Overhead Wires.

July 26th, 1883.

1. On the 15th March, 1883, the vestry appointed our committee, consisting of nine members, to advise jointly with the committee of St. Marylebone upon the course to be adopted by local authorities to protect the public from injury likely to arise from overhouse wires.

1A. On the 6th April, 1883, we reported that a meeting had been held, at which a committee of the St. James's vestry also attended, and that the Government had been asked to receive a deputation on the subject, and that the Corporation of London and the vestries and district boards of the Metropolis had been invited to join the deputation. We also reported that a letter had been written to the Postmaster-General, suggesting that licences granted to telephone companies should contain provisions prohibiting the companies from erecting overhouse wires. The vestry adopted the report and authorised us to represent them on the deputation.

2. We consider that the purpose of our appointment is now spent and that our only remaining duty is to report to the vestry what has been done and to state our view of the position in which the business stands.

3. The correspondence with the Post-office is given in the appendix to this report. It will be seen that the Postmaster-General is desirous of diminishing the extent of overhead wires, but that his powers for this purpose are very limited.

4. The deputation to the Local Government Board was attended by the representatives of the City of London and 15 vestries and district boards, and was received by the President with great courtesy. Its object was to point out the enormous increase of overhead wires, the danger of them, and the absence of all control over their erection. We did not presume to suggest any specific measure but only advocated the general principle that the laying of wires should be placed under regulation and control by some responsible public authority.

5. The President admitted that the carrying of wires over the public streets without any control might be attended with danger to the public and that if under the existing law the local authorities were powerless in the matter, legislation might be necessary. "There was," he said, "a question how far the fact that the streets were vested in the local authorities gave them control as regards wires carried over the streets, and this and other questions were raised in an action which had been brought by the Wandsworth District Board of Works, and until that case was decided it would be premature to express an opinion as to the necessity for legislation."

6. At the close of his answer the President read some sentences stating certain propositions of law according to the view of the legal advisers of the Government and he courteously repeated them at our request in order that an accurate note of them might be taken. Unfortunately, no such note was taken, or, at any rate, none such can now be procured. But we believe that it is correct to say that they did not contain any assertion of complete ownership by the vestry of the land constituting the highways, and we understood them to contain assertions that the wires may be nuisances or not, according to the facts of each case.

7. So ended the deputation, and we have now to remind the vestry of the position which they have taken ever since their adoption of the report of the Committee of Works on the 6th day of October, 1881.

8. It was stated in the House of Commons by the Prime Minister and the Attorney-General that the local authorities have the responsibility of seeing that the wires are placed so as not to cause danger. But the vestry were wholly unable to find the law which imposes such responsibility upon them or which gives them any corresponding power. They have some powers, though not very efficient ones, with respect to the operations of telephone companies and of the Postmaster-General. But the mass of the wires are laid either by telephone companies or by private persons, and as to such wires the vestry have no express power whatever unless they happen to be annoyances within the meaning of Sec. 119 of the Metropolis Management Act of 1855, in that case the vestry may take proceedings against them. For greater convenience, sec. 119 is set out in the appendix.

9. It is indeed suggested by the Local Government Board that the vestry have by law a right of property in the streets which would confer the requisite control. That can mean nothing available for the present purpose unless it means that the vestry have the complete ownership of the land: such ownership as by common law carries with it the dominion over all things down to the centre and up to the sky. If so, there is no doubt that they can prohibit the hanging of wires over the streets, because a trespass would thereby be committed on their property. But the suggestion is a new one. The only legal opinion we have seen—one taken on behalf of the City Commissioners of Sewers—is adverse to it. And on a careful examination of all such authorities as we can find in the books, we find some judicial dicta strongly adverse to it, and no decision or dictum which attributes to vestries any greater ownership of the highways than that of the surface and of such interest in the subsoil as is necessary for the performance of their duties. We have not the means of judging what questions may be decided in the Wandsworth case; but we shall be much surprised if any decision is elicited to support the view suggested by the Local Government Board.

10. Moreover, if the Local Government Board have been advised that each case must be decided according to its own circumstances, we would point out that such a principle is contradictory and destructive of the principle of complete domain. If we have the dominion of the air over the highways, our will alone is to determine whether a wire shall or shall not be suspended there, and no one wire can differ from another in that respect.

11. The result is that the opinion expressed in the Report, August 2nd, 1881 (adopted by vestry October 6th, 1881), has been confirmed by examination and discussion. The vestry can only interfere with such wires as by separate litigation in each case, under a doubtful enactment they may succeed in proving to be annoyances. Power of control properly so called they have none. Power of interference with wires actually erected they may have in some cases, each case resting on its own circumstances. When we asked that the erection of overhouse wires may be subject to regulation and control by public authority, we mean a control discretionary with that authority: such control as results from the necessity of procuring the consent of that authority to each operation, not such control as depends on the decision of a court of law on the varying facts of each case after the erection of the wires. Such a control is given to the Board of Works over pro-

jections into the streets, and is an effective control. Such a control was given to the Corporation of Liverpool with respect to overhouse wires by an Act passed in the last Session of Parliament. And we are unable to see how any satisfactory result can be reached unless the same principle is applied in London.

(On behalf of the Committee)

ARTHUR HOBHOUSE.

APPENDIX.

I.—Correspondence with Postmaster-General.

Court House, St. Marylebone, W.,
April 9th, 1883.

Sir,—The subject of overhead telegraph and telephone wires passing across the public streets has recently been under the consideration of a joint committee of the vestries of St. Marylebone, St. George, Hanover Square, and St. James, Westminster, and a communication was laid before the committee from Mr. Patey, the secretary to the Post Office, to the vestry clerk of St. George, Hanover Square, bearing date the 7th of February last, stating that you, Sir, the Postmaster-General, are fully alive to the objections to overhouse wires, and that you are using your best endeavours, consistently with the exigencies of the public service, to diminish the number of such wires which belong to the Government.

The committee having been informed that the Globe Telephone Company contemplate shortly forming a large number of telephone communications, I was directed to suggest to you the desirability of inserting in all licenses granted by yourself to telephonic companies provisions prohibiting them from erecting overhead wires, and making it compulsory that all wires should be laid underground.

The committee will feel obliged by your taking their suggestions into your consideration, as they are so much impressed with the evils likely to arise from the great increase in overhead wires, and they have recommended the vestries to request the Government to receive a deputation, with the view of urging further legislation upon the subject.

I am, Sir, your most obedient servant,
(Signed) W. E. GREENWELL,
Vestry Clerk, St. Marylebone.

The Right Hon. Henry Fawcett, M.P.,
Postmaster-General.

General Post Office, London,
April 25th, 1883.

Sir,—I am directed by the Postmaster-General to acknowledge the receipt of your letter of the 9th inst., suggesting that in all licences granted by this department to telephonic companies, provisions should be inserted prohibiting them from erecting overhead wires, and making it compulsory that all wires should be laid under ground.

Mr. Fawcett has given this suggestion his most careful consideration, but he feels that it would not be within the competence of this department to impose such a stipulation as that which you suggest, and that, moreover, the responsibility of prescribing in what manner the telephone companies are to erect their wires is not one which this department is called upon to assume.

I am also to point out that even if this department were in a position to accede to the suggestion of the vestry of St. Marylebone, the prohibition would only apply to wires erected for telephone exchange purposes, and would not prevent the erection of overhead wires for private and electric light purposes.

Mr. Fawcett also thinks it necessary to state that although, as he has said, this department is using its best endeavours, consistently with the exigencies of the public service, to diminish the number of overhead wires belonging to the Government, it will be impossible to dispense entirely with such wires without serious inconvenience to the public service, although every care is exercised to see that such wires are properly erected, and that their number is kept within the lowest possible limit.

I am, Sir, your obedient servant,
(Signed) C. H. B. PATEY.

W. E. Greenwell, Esq.,
Vestry Clerk of the Parish of St. Marylebone.

II.—Metropolis Management Act 1855, *Sec.* 119.

CXIX. If any porch, shed, projecting window, step, cellar door or window, or steps leading into any cellar or otherwise, lamp, lamp-post, lamp-iron, sign, sign-post, sign-iron, showboard, window shutter, wall, gate, fence, or opening, or any other projection or obstruction placed or made against or in front of any house or building after the commencement of this Act shall be an annoyance in consequence of the same projecting into or being made in or endangering or rendering less commodious the passage along any street in their parish or district, it shall be lawful for the vestry or district board to give notice in writing to the owner or occupier of such house or building to remove such projection or obstruction, or to alter the same in such a manner as the vestry or board think fit: And such owner or occupier shall within 14 days after the service of such notice upon him remove such projection or obstruction, or alter the same in the manner directed by the vestry or board: And if the owner or occupier of any such house or buildings neglect or refuse within 14 days after such notice to remove such projection or obstruction, or to alter the same in the manner directed by the vestry or board, he shall forfeit any sum not exceeding five pounds, and a further sum not exceeding forty shillings for every day during which such projection or obstruction continues after the expiration of such 14 days from the time when he may be convicted of any offence contrary to the provisions thereof.

GENERAL RULES FOR THE INSTALLATION OF INCANDESCENCE ELECTRIC LIGHTING.

THE question under consideration comprises the solution of several problems, some relating specially to the lamps and others to the dynamo-electric machine.

PROBLEMS RELATING TO THE LAMPS.

The Determination of the Current required for each Form of Lamp.

The most important point is to determine, says M. Adolphe Minet in *La Lumière Electrique*, the current strength required for a given luminous intensity. This knowledge for each lamp will give us, by a simple equation, the number of lamps to place in derivation for a given total current.

During the International Exhibition of 1881, experiments were made upon four types of lamps (Edison Lane-Fox, Swan, and Maxim). The committee was specially engaged in determining the value of these lamps—that is to say, the light in normal candles furnished per horse-power expended in each type of lamp.

Later on, Mr. Andrew Jamieson occupied himself with the same question; and he gave the result of his experiments in a communication to the Society of Telegraph Engineers and Electricians.

He constructed curves for several lamps, taking for the abscissæ the work expended and for the ordinates the luminous intensity.

Mr. Jamieson also proved that when the lamp emits an appreciable light, its resistance hot becomes one-half of its resistance cold. After this the resistance scarcely varies. In all the formulæ which we give for determining the current-strength for a given luminous intensity, we shall assume that the resistance of the lamp when hot is equal to one-half of the resistance cold.

Dr. Voit has utilised the observations of Mr. Jamieson and those of the Committee of the Munich Exhibition in endeavouring to ascertain the relation existing between the luminous intensity and the work expended in the lamp.

He represented Mr. Jamieson's curves by a simple analytical formula, supposing that the luminous intensity increases as the cube of the work expended.

Mr. Jamieson's curves have been produced by approximate calculations based upon the formula

$$L = \alpha\ (a)^3 \qquad (1.)$$

in which L represents the luminous intensity in normal candles; a the work disposable in the lamp expressed in volt ampères; α a coefficient which represents the luminous intensity produced per one volt-ampère unit in the lamp.

We obtain the volt ampères by multiplying the difference of potential at the terminals of the lamp by the current which traverses it,

$$a = \varepsilon i$$

The difference of potential ε may be expressed by the product of the resistance of the lamp hot, r, and the current in the lamp, i.

$$\varepsilon = r\, i \qquad (1.)$$

We may therefore say

$$a = r\, i^2$$

If we replace a by its value in formula 1, we have

$$L = \alpha\ (r\, i^2)^3$$

TABLE I.

LAMPS.	Luminous Intensities. L	Resistances (hot). R	Current in ampères. I	Volts. E	Volt-ampères. $a = E I$	Energy absorbed in kilogrammes. F_k	Energy in horse-power F_{ch}	Coefficient $\alpha = \frac{L}{a^3}$	Current required $I = \sqrt[6]{\frac{L}{\alpha R^3}}$	OBSERVERS.
Edison .....A	15·38	137·4	0·651	89·11	57·98	5·911	0·0735	0·000079	0·651	Exhibition Committee of 1881: MM. G.-F. Barker, W. Crookes, A. Kundt, E. Hagenbach, E. Mascart.
type 16 can. C	31·11	130·03	0·7583	98·39	74·62	7·604	0·115	0·000075	0·7583	
Swan .....A	16·61	32·78	1·471	47·30	69·24	7·059	0·094	0·000050	1·471	
„ .....B	33·21	31·75	1·758	54·21	94·88	9·67	0·1285	0·000039	1·758	
Lane-Fox ...A	16·36	27·40	1·593	43·65	69·53	7·089	0·0941	0·000049	1·593	
„ .....B	32·71	26·59	1·815	48·22	87·65	8·936	0·119	0·0000486	1·815	
Maxim .....A	15·96	41·11	1·380	56·49	78·05	7·939	0·106	0·0000336	1·380	
„ .....B	31·98	39·60	1·570	62·27	98·41	10·03	0·131	0·0000337	1·578	
Edison 7 .....B	14·3	60·6	0·874	53	46·3	4·72	0·063	0·000136	0·883	Jamieson.
	21·3	59·3	0·948	56·2	53·3	5·436	0·0725		0·954	
	35·8	57·8	1·060	61·1	64·7	6·600	0·088		1·054	
Edison Co. N³.. B. E. L.	14·2	74·2	0·825	61·2	50·6	5·16	0·0687	0·000116	0·818	
	20·3	73·4	0·870	63·6	55·3	5·64	6·075		0·873	
	26·3	73	0·920	67	61·6	6·28	0·0835		0·914	
Swan No. 1 ...	12·5	33·3	1·270	42·2	53·5	5·46	0·0727	0·000073	1·29	
	23·7	31·8	1·470	46·9	69·2	7·06	0·094		1·472	
	32·6	31·1	1·580	49·4	78·4	8·00	0·1065		1·569	
Swan No. V ... ground glass.	12	35·2	1·36	48	65·4	6·67	0·0887	0·000042	1·368	
	16	34·9	1·43	49·7	71	7·24	0·0965		1·443	
	20	34·8	1·50	52·1	78·1	7·97	0·106		1·498	
	30	33·8	1·62	54·7	88·6	9·04	0·121		1·634	
Lane-Fox	8·7	98·1	0·673	66	44·5	4·54	0·0603	0·000098	0·674	
	11·6	97·2	0·714	69·4	49·5	5·95	0·0791		0·711	
	30	95	0·838	80	67	6·82	0·091		0·843	
Maxim	14·6	39·1	1·25	48·9	61·1	6·22	0·083	0·000066	1·245	
	18·5	38·3	1·31	50·4	66·2	9·74	0·09		1·307	
	24·3	38·2	1·38	52·7	72·7	7·40	0·0985		1·370	
	33·4	3·77	1·48	55·1	80·3	8·19	0·109		1·446	
Edison A, No. 1	12·003	160·9	0·632	101·7	64·27	6·56	0·0875	0·000047	0·613	Munich Committee.
	14·785	160·4	0·651	104·4	67·96	6·93	0·0924		0·628	
	18·475	158·3	0·678	107·6	72·96	7·44	0·099		0·681	
Edison A, No. 2	14·535	138·7	0·743	103·1	76·60	7·81	0·104	0·0000305	0·750	
	17·333	139·6	0·778	108·6	84·48	8·62	0·115		0·771	
	21·159	136·3	0·807	110·1	88·87	9·06	0·121		0·805	
Edison B, No. 1	6·653	69·24	0·757	52·40	39·66	4·05	0·054	0·00001459	0·759	
	15·571	66·08	0·896	59·22	53·08	5·41	0·0722		0·895	
Maxim L, No. 1	17·975	48·46	1·344	65·14	87·57	8·93	0·119	0·0000248	1·361	
	30·652	46·30	1·506	69·71	105	10·74	0·1429		1·521	
	43·500	44·54	1·642	73·12	120	12·24	0·163		1·708	
Maxim L, No. 2	21·571	46·60	1·353	63·05	85·30	8·67	0·1155	0·0000312	1·380	
	42·476	44·90	1·573	70·64	111·10	11·32	0·151		1·575	
Small Swan L, No. 1	11·101	30·01	1·226	36·80	45·14	4·6	0·061	0·0001024	1·260	
	14·909	29·92	1·318	39·46	51·98	5·3	0·0705		1·328	
	28·103	29·65	1·489	44·16	65·75	6·7	0·0892		1·481	
Large Swan L, No. 5	13·005	85·65	1·084	92·87	100·70	10·27	0·137	0·0000114	1·110	
	18·334	83·58	1·161	97·05	112·70	11·47	0·153		1·184	
	23·136	81·99	1·230	101·50	125·80	12·83	1·171		1·143	
Siemens No. 1 .	13·868	101	0·915	92·43	84·30	8·6	0·1145	0·0000233	0·913	
	17·157	101	0·946	95·60	90·50	9·23	0·123		0·942	
	24·294	99·70	1·005	100·20	100·80	11·28	0·150		1·002	
Siemens No. 2 .	14·267	105·9	0·923	97·68	90·11	9·19	0·122	0·0000195	0·927	
	17·170	104·6	0·956	100·10	95·72	9·76	0·130		0·961	
Siemens No. 3 .	11·938	108·70	0·844	91·65	77·32	7·89	0·103	0·0000268	0·839	
	17·742	107·10	0·906	96·99	87·82	8·96	0·119		0·902	
	22·524	106·90	0·935	100	93·52	9·54	0·127		0·941	
Small Müller, No. 5	10·170	61·35	1·063	65·22	69·33	7·07	0·094	0·0000286	1·075	
	17·661	59·67	1·189	70·95	84·36	8·6	0·1145		1·212	
	24·111	60	1·238	74·28	91·96	9·38	0·125		1·259	
Small Müller, No. 6	22·385	57·69	1·305	75·29	98·25	9·93	0·132	0·0000228	1·313	
	41·350	55·68	1·485	82·57	112·25	11·47	0·153		1·482	
Müller average No. 1	13·332	57·84	1·445	83·58	120·80	12·32	0·164	0·000071	1·466	
	21·338	56·68	1·575	89·16	140·30	14·31	0·190		1·650	
	43·606	54·14	1·847	100	184·70	18·84	0·251		1·839	
Müller average No. 2	24·529	68·70	1·423	97·75	139·10	14·19	0·188	0·000092	1·422	
	54·236	65·42	1·660	108·60	180·28	18·39	0·245		1·661	
Müller (large) No. 1	23·643	70·88	1·710	121·20	207·30	21·11	0·281	0·0000025	1·721	
	39·518	69·59	1·877	130·60	245·20	25·01	0·333		1·899	
	61·257	68·07	2·065	140·60	290·40	29·62	0·395		3·088	
Cruto	10·208	8·187	2·702	22·12	59·77	6·09	0·081	0·0000325	2·88	
	14·632	8·173	3·106	25·38	78·82	8·04	0·107		3·067	
	19·687	8·174	3·257	26·62	86·70	8·84	0·48		3·222	

We obtain from this equation the current required with this lamp for a luminous intensity L.

$$i = \sqrt[6]{\frac{L}{\alpha r^3}} \qquad (2.)$$

The determination of the coefficient α, for a given type of lamp, is effected by ascertaining, by the ordinary photometric method, the current capable of emitting, in the lamp, a mean luminous intensity (about 20 candles) in the horizontal plane. To represent the mean spherical intensity, the coefficient must undergo correction. In the report on the measurements given by the committee at the Munich Exhibition, Dr. Voit describes the methods employed by Prof. Hazenbach for determining the mean luminous intensity emitted by the lamp in the horizontal plane, and the coefficient of reduction of the mean spherical intensity.

We shall take as the practical coefficient that which is obtained from the mean emission of light in the horizontal plane.

The values of the coefficient α determined for each lamp emitting a mean horizontal intensity of 20 normal candles are very nearly the same as those given by Dr. Voit from the curves of Mr. Jamieson. They are expressed by the formula

$$\alpha = \frac{L}{i^6 r^3}$$

Dr. Voit has determined α for 22 types of lamp, among which six types have been examined by Mr. Jamieson and 16 by the committee of the Munich Exhibition. Numerous experiments were made upon each lamp; the values of α, given in table 1, represent the mean of a great number of observations.

I have calculated, by means of formula 2, the values of i for luminous intensities which I chose, on purpose, most remote from each other.

We see from the table that the calculated current required is practically the same as that measured.

(To be continued.)

NOTES.

Electric Lighting.—The Swan United Electric Light Company has secured the order for lighting the s.s. *Adriatic*, of the White Star Line, with 132-20 C.P. and 150-12 C.P. lamps, with duplicate alternate current machines, and two pairs of coupled 6 H.P. Marshall engines, driving by ropes. The work is to be completed early in January.

At the meeting of the City Commissioners of Sewers on Tuesday, the Electric Lighting Committee brought up a report stating that the proposals by the companies with a view to contracts to be embodied in the Commissioners' license had been so vague and unsatisfactory, that it had been found impossible to come to any terms, except with the Edison and Gülcher Companies. The Edison Company proposed to enter into a contract for the Holborn Viaduct and the General Post Office, and they would supply the public lamps within the area on the same terms as those now in force with the gas company. To private consumers it proposed to charge at a maximum rate of 9d. a unit. The Gülcher Company proposed to light, compulsorily, a certain area, including Bishopsgate Street, from Threadneedle Street to Houndsditch, and Aldgate High Street. It suggested also a large permissive area. For street lighting the maximum charge would be £1 5s. per quarter for the current necessary for each 20 candle-power nominal Crookes' incandescent lamp, £2 7s. 6d. for each 40 candle-power lamp, and £12 10s. per quarter for each Gülcher arc lamp of 2,000 candle-power nominal. For private lighting the price would be 8½d. per commercial unit. For carrying the wires into private houses the company would charge for each Crookes' lamp at 5s., and in addition the customer would have to pay for fixing at a rate per foot of wire, depending on the number of lamps and the cost of excavation, breaking walls, ceilings, &c., and making good. As regarded the public lighting, it was estimated that the proposal of the company would provide at least 30 per cent. more light than was now received from gas at the same cost. In submitting the proposal of the two companies as the basis of provisional agreements to be entered into with them in view of the application to the Board of Trade for a license, the committee was not unmindful of the fact that the Commissioners in obtaining such licence would assume to themselves serious responsibilities, failing the completion and proper fulfilment of agreements by the companies, but it was advised that the proposals were in themselves fair and reasonable, and it therefore recommended that they should be accepted, conditional upon sufficient guarantees being furnished by the companies. Mr. Stoneham moved the adoption of the report, and, after a discussion, it was carried, with a rider by Mr. Innes, that in agreeing to the report, the Commissioners directed the Streets Committee to proceed with public and private lighting in parts not covered by the electric lighting companies.

A gentleman who has been in communication with M. de Lesseps respecting the utilisation of the electric light on the Suez Canal, has received a reply, says the *Dundee Advertiser*, which is translated thus:—

"I have the honour to acknowledge the receipt of your letter of September 12th last, and to acquaint you that our Committee of Direction has already come to a decision relative to the application of the electric light to the Canal. We can only, therefore, thank you for the information contained in your letter. Accept, Sir, the assurance of my distinguished consideration.—(Signed) F. DE LESSEPS. *October 16th*, 1883."

The electric lighting of the Leeds Town Hall during the recent Musical Festival was so eminently satisfactory that the Town Council, we hear, have decided to adopt it permanently.

A voluntary association for the succour of the wounded, which is bound by its statutes to give its services in case of war, went through a series of operations in Vienna on Monday night by the electric light, in order to test its efficiency on the battle-field. A powerful arc light, with a reflector, was set up at the eastern entrance of the Rotunda, and it illuminated a large extent of ground, on which were placed 50 persons, supposed to be wounded. The ambulance-bearers and doctors then appeared on the scene with their instruments and appliances, and hastened to and fro as though to render assistance. The vehicles used were lighted with electric lamps. The Crown Prince Rudolph, several of the archdukes, and thousands of spectators witnessed this novel and interesting sight.

The underground wire system for electric arc lighting, says the *Boston Advertiser*, does not seem as yet to have been perfected so as to make it practicable or trustworthy. The New England Weston Electric Light Company of this city has been experimenting for some months with an underground cable to run its lights in Park Square and in front of the Providence depôt, but there have been several periods when it has been necessary to run the lights by overhead wires. Recently the cable was dug up, and it was found that the heavy copper conductor had been burned and the insulating covering destroyed for several inches by the intensity of the current. A lead-covered cable is now being laid in a box or conduit of wood, and it is hoped that this may work satisfactorily.

The Thomson-Houston Electric Company, of Boston, has received the first prize for the best arc system of electric lighting, and for the best arc lamps, shown at the Cincinnati Exhibition. We have already described this system.

A decision was rendered on the 8th inst. by the Commissioner of Patents in the interference case of Sawyer and Mann against Thomas A. Edison, which

involves the question of priority in the invention of "an incandescent conductor for an electric lamp formed of carbonized paper." The Commissioner awards the patent to Sawyer and Mann, and in so doing reverses the decision of the Board of Examiners-in-Chief made on July 28th, 1883, by which priority was awarded to Edison. (See our "Notes" columns for September 22nd.) Commissioner Marble is of opinion that the conductor of which Edison claims to have been the inventor and the Sawyer and Mann conductor are substantially the same, and that the testimony shows that Sawyer and Mann had the conductor in a rude form in March, 1878, and in a perfected form in September or October, 1878, while Edison did not have his conductor perfected until October, 1879. This decision, says the New York *Electrical Review*, only affects Edison's right to a patent for an incandescent conductor made of carbonized paper. He already holds patents for such conductors made of carbonized bamboo, willow, and other substances which, it is said, he uses in nine out of ten of the lamps made by him. A decision in his favour would, however, have secured to him the entire control of the manufacture of carbonized conductors, as paper is the only substance of which such conductors are at present made that is not covered by his patents. The decision of the Commissioner is final as far as the Patent Office is concerned, but an appeal to the Secretary of the Interior is yet open, and should the Secretary affirm the Commissioner's decision, Mr. Edison may file a bill in equity to compel the issuance of a patent to him in the United States Circuit Court, and thus bring the question before the legal tribunals.

Telephonic.—The McDonough Telephone Company was incorporated at Albany, N. Y., on the 6th instant. The capital is $1,000,000, with the proviso that it may be increased to $20,000,000. The principal office will be in New York. The lines are to extend from New York to San Francisco, New Orleans, Portland, Me., Boston, and other places. American news is to the effect that the formation of the company is due to the United States Telephone Manufacturing Company of New York. In order to do a telephone and telegraph business, it was found necessary to organise a new company. The telephones used will be of the McDonough patent.

A dispatch from Washington says that Messrs. Edison, Voelker and Irwin have appealed from the decision of the Examiner of Interferences in the telephone case which recently sustained certain claims of A. G. Bell. Edison, Gray and Bell have, on the other hand, appealed against the award to McDonough of the telephonic receiver.

The Bengal Telephone Company in Calcutta has decided on the employment of female assistants as "operating clerks" on their exchange, and with this object has advertised for candidates.

A New Telephone Company.—A copy of the prospectus of the St. George Telephone Company, Limited, has been forwarded us. According to it the share capital is to be £300,000, divided into 60,000 shares of £5 each. The first issue (of 30,000 shares) to be payable as follows :—on application £1, on allotment £1, and the balance as and when required. The directors are :—W. D. Chester, Esq., Selborne, Walton-on-Thames; Capt. C. A. McEvoy, 18, Adam Street, Adelphi; Arthur French St. George, Esq., Radnor House, Redhill, Surrey; F. Pendered, Esq., 1, Richmond Villas, Union Road, Holloway. Consulting electrician, A. F. St. George, Esq. Secretary, R. S. Tomlin, Esq. The offices at 20, Bucklersbury, London, E.C.

The document also states that: "This company is formed to carry on the business of a telephone and telegraph company, and to establish, work, and regulate telephone exchange systems in London and throughout the United Kingdom. The objects of the company are to manufacture, sell, use, and let on moderate terms the St. George telephone inventions, under the following Letters Patent :—1882; 25th February; No. 922: Transmitting and receiving audible signals by electricity.—1883; 21st February; No. 965: Improvements in methods of, and apparatus for, transmitting audible signals by means of electricity.—And any further patented improvements made by Mr. A. F. St. George. The sole and exclusive right of the patents for the United Kingdom have been secured by this company.

"This company will supply telephonic instruments, simple and reliable in their action, at the price of £7 17s. 6d. each instrument (*i.e.*, receiver and transmitter) when the instruments become the property of the purchaser. Instructions and diagrams will enable anyone to erect the instruments. The company's business is now in operation. The instruments can be seen, heard, and tested at their offices.

"Taking as a basis the receipts and expenditure of established companies, and considering the favourable profits to be derived from the sale of instruments, the directors consider that with economical management, cheap tariffs, and prompt and reliable telephonic service to the public, the company will be enabled to pay remunerative dividends.

"As a preliminary step, the company has obtained the Postmaster-General's licenses for central office or exchange system for London, Liverpool and Manchester, and the company intend forthwith to establish the same for public use at the yearly rental of £10 10s., being only about one-half of the usual rental charged by other companies. A day and night service will be provided wherever necessary."

Private line business is also, according to the prospectus, "an exceedingly remunerative and almost untouched field for private telephone lines."

"The only contract entered into is an agreement between the company and Mr. A. F. St. George, dated August 9th, 1883, for acquiring the patent rights as above mentioned for £40,000, payable in the shares of the company. No promotion money has been or will be paid, all expenses in relation to the formation of the company being paid by Mr. A. F. St. George."

The last paragraph quoted above is a very important one, for *if anything* could give the public confidence in the scheme, the fact that Mr. George is to bear all preliminary expenses, and that he is to be paid only in the shares of the company should (other things being favourable) command it.

The New Atlantic Cables.—The Paris *Figaro*, in its issue of Friday last, contains an account of an interview which one of its editors, M. Pierre Giffard, had with Mr. Gordon Bennett, on the subject of a new Atlantic cable. M. Giffard calls this "le cable Bennett-Mackay," as the substance of what the former gentleman stated was, that he had arranged with Mr. Mackay to complete the enterprise at a cost of 35,000,000 frs.—£1,400,000 sterling—they alone providing the necessary funds and asking no support whatever from the public in the form of subscriptions to the share capital. The new cable, it further appears from what Mr. Bennett stated, is to be opened in July next year, the manufacture of it having been undertaken by "the Brothers Siemens, who will begin their work at once. The charge for messages has not yet been fixed, but in any case it will be much below—*très inférieure*—the existing charge, as the main object is to cheapen the rates. As Mr. Bennett put it, "We deposit 35,000,000 frs. of our money at the bottom of the ocean to have a cable to ourselves and to realise economical progress." Naturally there there will be no amalgamation with existing companies. Profit is no object, and there are none of the usual promotion and other expenses to be defrayed. The great end of the two capitalists is not gain, but "progress by a loyal agreement," competition being the life of trade. Other particulars given are to the effect that there will be a station for England and one for France, probably at Brest, and it is hoped that M. Cochery will grant a special wire for Paris. Mr. Bennett appears to have referred to Mr. Jay Gould as having failed to carry out the idea with which he started his cable, inasmuch as he sold what had cost him 35,000,000 frs. to the Western Union Telegraph Company for 60,000,000 frs.—a profit of exactly a million sterling—with the result that the Atlantic is monopolised, and that all the world has to pay a tax in order to provide interest on an enormously swollen capital. These appear to be the chief points upon which Mr. Bennett touched, and it has only to be added that Mr. Garrett, of the Baltimore and Ohio Railway Company, is understood to have since joined the Mackay-Bennett combination. As the cable is not started with any view to profit, and the public will not be asked to subscribe, criticism on its prospects is hardly needed. If half a dozen wealthy Americans choose to fling £1,400,000 to the bottom of the Atlantic not for gain, but for a sincere wish to hasten human progress,

that is their own affair. It may be pointed out, however, that Mr. Bennett under-estimates the cost of what M. Giffard calls his "noble and good idea."

The *Daily Telegraph* makes the following comment on the *Figaro's* remarks :—

Two cables at least will be wanted to secure complete independence of the existing organisation, and how long the American capitalists mentioned will consent to let nearly three millions sterling lie in the depths of the Atlantic, yielding no return to themselves in the shape of interest on their outlay, is a problem on which it is useless to speculate, but which, we cannot help thinking, need not cause much disquiet to shareholders of the existing companies.

The *Daily Telegraph*, we think, need not fear that American financiers will let their money lie unprofitably at the bottom of the ocean. Indeed, judging by what is stated in the above-quoted paragraph of the *Figaro*, namely, that Mr. Jay Gould sold what cost him 35,000,000 frs., for 60,000,000 frs., we should say that financing new Atlantic cables is very profitable indeed—a profit, in fact, which is exceptionally great. Moreover, cables are steadily cheapening; the necessary capital therefore to lay them is represented by much smaller figures than formerly, and new cables consequently become proportionably dangerous to the older companies, the danger, necessitating as it does, the getting rid of their competition by purchase or amalgamation, at rates most profitable to the junior organisations. We differ entirely from the *Telegraph* in its expressed opinion. We think that there is more cause than ever for disquiet on the part of the shareholders of the existing companies.

Arrangements are at present proceeding for two distinct pairs of cables, but it will be evident to all that a concentration of the strength, of both parties, on one pair of cables only, would bring about an opposition to the existing companies which would be most disadvantageous to them. We have more information on this subject at hand, but are not at present at liberty to communicate it.

Electrical Companies' Shares.—At the Stock and Share Auction and Advance Company's sale on Thursday, fully paid shares of the Maxim-Weston Electric Company realised 5s. 9d.; those of the Electrical Insulator Manufacturing Company, 14s., and those of the Jablochkoff Electric Light and Power Company, 15s. One hundred shares of the last-named company were put up for sale, only 20 of which were disposed of. Shares of the Electric Sun Lamp and Power Company found no bidder.

Personal.—We are informed that Mr. Henry F. Joel, C.E., has opened offices in Tower Chambers, Moorgate Street, E.C., where he intends practising as a consulting electrical engineer.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Gérard & Company, Limited, Electrical Engineers and Manufacturers.—The statutory return of this company made up to the 23rd of August, was filed on the 30th of August. The nominal capital is £40,000 in £10 shares, whereof 1,000 are preference and 3,000 are ordinary shares; 568 preference and 2,543 ordinary shares have been taken up; upon the former £5,430 is considered as paid up, and the full amount is considered as paid up upon the ordinary shares. Registered office: 11, Queen Victoria Street.

Kelway's Electric Log Syndicate, Limited.—The statutory return of this company was made up and filed on the 19th of June. The nominal capital is £6,500 in £10 shares. 575 shares have been taken up; the full amount has been called up and paid upon 400 shares, and £5 per share upon the remaining 175 shares. The total calls paid amount to £4,679, leaving £196 unpaid. Registered office: 58, Lombard Street.

Liepmann Carbon Company, Limited.—The statutory return of this company, made up to the 22nd May, was filed on the 13th of July. The nominal capital is £30,000 in £100 shares. The number of shares taken up is 76. Upon 16 shares the full amount has been called, and £15 16s. 8d. upon each of the remaining 60 shares. The calls paid amount to £2,550. Registered office: 302, West Ferry Road, Nelson Wharf, Millwall.

John Northam & Company, Limited (Electrical Signal Manufacturers).—The statutory return of this company, made up to 11th of July, was filed on the 18th of July. The nominal capital is £500 in £5 shares. 48 shares have been taken, and two calls of 10s. per share payable on July 26th and October 26th respectively have been made. £12 has been received by the company in advance of calls. Registered office: 30, Norfolk Street, Sheffield.

Electric Lighting Contract and Maintenance Company, Limited.—The final winding-up meeting of the shareholders in this company was held on the 1st inst., when an account was given showing the manner in which the winding-up of the company had been conducted, and the property of the company disposed of. A notice to this effect was duly registered on the 16th inst.

NEW COMPANY REGISTERED.

Latimer Clark, Muirhead & Company, Limited.—Capital, £1,000,000, in £10 shares. Objects :—The carrying on of the business of telegraphic and electrical engineers and electricians. Signatories (with one share each) :—J. L. Clark, C.E., 6, Westminster Chambers; J. Muirhead, Farquhar Road, Upper Norwood; J. Muirhead, jun., C.E., 20, Regency Street, S.W.; H. Bell Syer (telegraph engineer), Mayfield Road, Wimbledon; Alexander Muirhead (electrical engineer), 20, Regency Street, S.W.; F. L. Muirhead, 3, Elm Court, Temple; A. Pentland, Farquhar Road, Upper Norwood. The signatories are to nominate the first directors; qualification, shares or stock to the nominal value of £250; remuneration, £1,000 per annum. Registered 22nd inst., by Bompas, Bischoff & Dodgson, of 4, Great Winchester Street, E.C. Registered office: 29, Regency Street, Westminster.

BILLS OF SALE FILED.

Wilde, Joseph, 4, Holme Road, Hope Road, Sale, and **Hill, John,** 16, St. Oswald's Grove, Rochdale Road, Manchester, electrical engineers, carrying on business in co-partnership at 37, Mill Street, Ancoats, Manchester, to Henry Wilde. Dated October 11th; filed October 13th. £3,000.

CITY NOTES, REPORTS, MEETINGS, &c.

The Yorkshire Brush Electric Light and Power Company, Limited.

AN extraordinary general meeting was held at the Cannon Street Hotel on Tuesday, to consider and, if deemed expedient, to pass resolutions amalgamating the company with the Hammond Electric Light and Power Supply Company. Mr. H. W. Lowe, the chairman, presided.

The Secretary (Mr. G. L. Morton) having read the notice convening the meeting,

The Chairman said: When we last met to consider the balance sheet, I stated to you that we were then on the point of concluding an arrangement for the amalgamation of our business with that of another company. Shortly afterwards we arrived at an agreement, and in accordance with our promise, we lost no time in advising you of the terms of that agreement, and we convened this meeting in order that we might consider the same. I think that those terms, after careful consideration, must thoroughly recommend themselves to the minds of every one who has carefully studied our position and prospects as well as the difficulties which lie before us, and we hope that they will prove acceptable. It has been evident to the board lately that we cannot recommend to our shareholders the continuance of the business with its present burdens. The transfer now proposed will remove these burdens from us, and in exchange for our unmarketable shares we shall have an interest-bearing saleable security, which alone is a

very desirable thing. I notice that the Hammond shares, on which £3 15s. has been paid, were quoted quite recently at 3¼. There is a further call upon these, due towards the end of the year of 25s., making £4 15s., which we are to receive in exchange for six of our shares. That is, roughly, equivalent to 16s. a share of our capital, and I think those terms must be admitted to be favourable for us. They are also favourable in some measure to the Hammond Company, because with the expenses removed I see no reason why in a fair time the business we shall hand over to the Hammond Company shall not be a remunerative one, and one on which they can congratulate themselves. The staff they have is able to work our business, and thus there will be a saving of a large expenditure. It is not so long since the Hammond shares were quoted at a very large premium, and I see no reason why in the future, with the prospects before them, the same should not occur. In that case our shareholders who hold on to the new shares may receive the full benefit, and recoup themselves the present nominal loss. I will now ask the solicitor to read to you the draft agreement we have entered into.

The Solicitor, Mr. Browne (Messrs. Linklater & Co.), then read the draft agreement. It provides for the amalgamation of the two companies on the terms of the Hammond Company surrendering to the Yorkshire Company the 17,060 fully paid-up shares in the Yorkshire Company which it still holds, and also agreeing to allot and issue to the Yorkshire Company for distribution amongst its shareholders fully paid-up £5 shares of the Hammond Company in the proportion of one fully paid-up £5 share of the Hammond Company for every six £2 fully paid-up shares in the Yorkshire Company. The Yorkshire Company will, in consideration of this, transfer to the Hammond Company all its undertaking, property, assets and effects whatsoever, the Hammond Company undertaking to bear and pay all liabilities, and also the costs of the agreement, and of winding up and dissolving the Yorkshire Company, which will be proceeded with as soon as the amalgamation is carried out.

The Chairman then moved the following resolutions:—(1.) "That it is expedient to effect an amalgamation of the Yorkshire Company with the Hammond Electric Light and Power Supply Company, Limited (hereinafter called the Hammond Company)"; and (2) "That the agreement now submitted to this meeting, and expressed to be made between the Yorkshire Company of the one part and the Hammond Company of the other part, be, and the same is, hereby approved, and that the board of the Yorkshire Company be, and they are hereby, authorised to carry the same into effect."

General Bates seconded.

Mr. McAlister desired to have some information as to their prospects after the amalgamation.

The Chairman replied that if Mr. McAlister had been present at the commencement of the meeting he would not have found it necessary to ask such a question. He, however, repeated his former remarks, adding that the Hammond Company was, he believed, making a somewhat similar arrangement with the Birmingham and Warwickshire Company.

The motion was then put and unanimously carried.

The Chairman explained that so general was the feeling as to the advisability of the amalgamation that they held proxies in its favour representing 29,647 shares. A purely formal meeting would shortly have to be held to meet the requirements of the Companies' Acts, and he hoped they would be able to carry out the terms of the agreement soon after November 15.

A vote of thanks to the chairman closed the meeting.

The West India and Panama Telegraph Company, Limited.

THE thirteenth ordinary general meeting will be held at the Cannon Street Hotel, on Wednesday, at which the following directors' report, for the six months ended 30th June last, will be submitted:—

The amount to credit of revenue is £52,641 1s. 1d., and the expenses have been £30,370 1s. 5d., leaving a balance of £22,270 19s. 8d., which, with the balance of £6,201 4s. 7d. brought from last account, makes a total of £28,472 4s. 3d. Continuing the policy approved by the shareholders at the last meeting, and having in view coming expenditure, the directors have placed £20,000 to the reserve account, which now amounts to £81,843 13s. 7d., leaving £8,472 4s. 3d. available, with which it is proposed to deal as follows:—Payment of 3s. per share on account of arrears of dividend on the first preference shares, £5,184 9s.; balance to current half-year's account, £3,287 15s. 3d. —£8,472 4s. 3d. The traffic receipts show an increase of £2,443 11s. 3d., as compared with the corresponding period of 1882, chiefly due to special traffic during an interruption of the cables belonging to the Central and South American Company, the general traffic showing no material improvement. Years of patient sacrifice on the part of the shareholders have clearly demonstrated that, to place the undertaking in a financial position which will enable it permanently to maintain an efficient service, the principle of direct contributions under which the cables were laid must be extended by increased subsidies. It is with great satisfaction that the directors have to report that the Colony of Trinidad, recognising the efforts which have been made to strengthen and maintain the system, has increased its subsidy from £2,500 to £6,000 per annum, from 1st January, 1883. The encouragement given to the enterprise by the liberal action of that colony deserves the warmest acknowledgment from the Company, and proves the advisability of continuing the policy adopted. The directors hope that the example thus set by the important Colony of Trinidad, as well as that of British Guiana, will induce the other colonies to hesitate no longer in granting proportionate increases to their subsidies. During a period of immunity from interruptions, the directors were able to take measures for completing the examination of the original Jamaica-Porto Rico section. These examinations show a good prospect of putting this section into working order. To provide for these repairs, and to replenish the stock in the West Indies, a contract was entered into with Siemens Bros. and Company, Limited, for the manufacture of 250 knots of deep-sea cable, with which the company's repairing ship "Grappler," ordered home for the purpose, sailed for the West Indies on the 2nd inst. This repair, if successfully accomplished, will form another important addition to the measures already taken for strengthening the communications.

The Direct Spanish Telegraph Company, Limited.—The use of code or cypher in telegrams, which was prohibited by the Spanish Government in August last, is now allowed, and telegrams in code can therefore be forwarded to all places in Spain.

The Eastern Telegraph Company, Limited.—This company announces that telegrams written in code can now be accepted for all parts of Spain subject to the rules of the International Telegraph Convention.

The Direct United States Cable Company, Limited.—The Board has resolved upon the payment of an interim dividend of 5s. per share, being at the rate of 5 per cent. per annum for the quarter ending September 30, 1883, such dividend to be payable on and after November 16.

Settling Day.—The Stock Exchange Committee appointed yesterday (Friday) settling day in the following security:—Maxim-Weston Electric Company, Limited, new shares.

LATEST QUOTATIONS.

Authorised Issue.	Shares.	Name.	Paid.	Closing Quotation, Oct. 24.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	8	2¼-2⅝	2⅜a.
		Do. Do.	10	4 - 5	4¼m.
30,000	5	Australasian E. L., Power & Storage Co.	3	¼ - ⅝	
24,900	10	British Insulite Co., Ld., "A" Shares.	5	1 - 2	
30,000	5	Brush Elec. Lt. & Power Co. (Scotland)	2½	⅜ - ½	
25,000	5	Gt. Western Electric Light & Power Co.	2½	¼ - ⅜	
24,980	5	Hammond Elec. Lt. & Power Sply. Co.	2½	2¼ - 2⅜	2⅜-⅜m.
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	2	..	
172,500	1	Maxim-Weston Elec. Lt. & Power Co.	1	½ - ¾	
..	..	Metrop. Brush Electric Lt. & Power Co.	3	..	
40,000	5	Pilsen Loel & Gen. Elec. Lt. Co.	2½	..	
..	..	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.	2½	1⅝ - 2	
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	44½ - 45½	44-⅞a. 44½-⅝m.
2,441,800*l.*	Stk.	Do. Pref. } Def. receiving no div. until	100	74½ - 75½	75-⅛a. 75⅛m
2,441,800*l.*	Stk.	Do. Def. } 6 p. c. paid to Pref.	100	15 - 16	15a.
130,000	10	Brazilian Submarine, Limited	10	10½ - 10⅝	10⅜a-10⅝-⅛m
16,000	10	Cuba, Limited	10	10½ - 11	
6,000	10	Do. 10 per cent. Preference	10	17 - 18	
13,000	10	Direct Spanish, Limited	9	5⅛ - 5⅜	
6,000	10	Do. 10 per cent. Preference	10	15½ - 16	15⅝m.
65,000	20	Direct United States Cable, Ld., 1877	20	11½ - 11⅝	11⅝a.
100,000*l.*	100	Do. 6 per cent. Deb., repayable 1884	100	93 -101	
380,000	10	Eastern, Limited	10	10⅜ - 11	10⅜-⅝-11⅛a.
70,000	10	Do. 6 per cent. Preference	10	12⅜ - 13⅛	
232,000*l.*	100	Do. 6 do. Debs., repayable Oct. 1883	100	..	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	102-104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	104-108	105a.
199,750	10	Eastern Exten., Australasia & China, L.	10	11⅜ - 11⅝	11⅜-⅜-11⅝a. 11½m.
320,000	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	107 - 110	
500,000	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	103 - 107	
140,000	100	Do. do. reg., repayable 1900.	100	103 - 107	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	103 - 106	
234,300*l.*	100	Eastern & South African, Ld., 5 p. c. } Mort. Deb. Rg. redeemable 1 Jan. 1900 }	100	102- 105	
345,700*l.*	100	Do. do. do. To Bearer.	100	102- 105	
22,050	10	German Union Telegraph & Trust, Ld.	10	10 - 10⅜	
165,200	10	Globe Telegraph & Trust, Ld.	10	7⅛ - 7⅜	7⅛-¼a.
165,200	10	Do. 6 per cent. Preference	10	12⅝ - 13	12⅝a.
125,000	10	Great Northern	10	12⅝ - 13⅛	12⅝
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
200,000	100	Do. 5 per cent. Debentures	100	100 -103	102¼.
31,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	30 - 31	
100,000	100	Do. 6 per cent. Debs., 1886	100	102-105	
17,000	25	Indo-European, Limited	25	32 - 33	32⅛m.
38,148	10	London Platino-Brazilian, Limited	10	3⅛ - 4	
12,000	10	Mediterranean Extension, Limited	10	1½ - 1⅝	
8,200	10	Do. 8 per cent. Preference	10	2 - 4	
9,000	8	Reuter's, Limited	8	8½ - 9	
280,000	Stk.	Submarine	100	215 -225	
58,225	1	Do. Scrip	1	1⅛ - 2⅛	
4,200	Cert.	Submarine Cables Trust	100	102 -105	102a.
37,750	12	Telegraph Construction and Mainten.	12	35½ - 36½	36⅛ ⅛.
150,000	100	Do. 6 per cent. Bonds, 1884	100	1⅛ - 1⅜	
185,750	5	Do. 2nd Bonus Trust Cert.	2½	1⅛ - 2	
30,000	10	West Coast of America, Limited	10	4⅜ - 5⅛	
150,000	100	Do. 8 per cent. Debs.	100	106 -108	107⅛a.
69,910	20	Western and Brazilian, Limited	15	5⅛ - 5⅝	
		Do. Preferred	7½	4 - 4⅛	
		Do. Deferred	7½	¾ - 1	
200,000*l.*	100	Do. 6 p. c. Debs. "A" 1910	100	105 -106	
2,500	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	94 - 97	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	122 -124	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	100 -103	
88,321	10	West India and Panama, Limited	10	⅜ - 1	⅝a.
34,563	10	Do. 6 per cent. 1st Preference	10	6½ - 7⅛	
4,669	10	Do. 6 do. 2nd do.	10	5 - 5⅛	
		TELEPHONES.			
154,165	1	Con. Tele. & Mainten., L., Nos. to 154,165	1	⅛ - ⅜	
200,000	1	Oriental Tele. Co., Nos. 80,001 to 300,000	⅛	⅛ - ⅜	
100,000	5	United Telephone Co.	5	8 - 8⅛	

NEW PATENTS—1883.

4815. "Electric arc lamps." H. W. PENDRED. Dated October 10.

4835. "Magneto generators of electricity." M. BENSON. (Communicated by J. P. Stabler.) *Complete.* Dated October 11.

4861. "Process of galvanising wires by galvano-plastic process." L. A. GROTH. (Communicated by E. Deutgen.) Dated October 12.

4875. "Electric arc lamps." W. H. AKESTER, R. MITCHELL. Dated October 13.

4879. "Treating gold ores or other auriferous substances, and more especially rebellious or refractory gold ores, and concentrates, by electrolysis, without previously furnacing the same." H. R. CASSEL. Dated October 13.

4880. "Telephonic apparatus." G. L. ANDERS. Dated October 13.

4881. "Electrical belt, chiefly designed for medical purposes." C. B. HARNESS. Dated October 13.

4883. "Transmitting marks, writings, characters, code signals, and the like from station to station distant from each other." M. T. NEALE. Dated October 13.

4885. "Dynamo-electric machines." C. H. BENTON. Dated October 13.

4898. "Coupling electric accumulators employed for the production of motive power for application to various purposes." A. C. HENDERSON. (Communicated by G. Philippart.) Dated October 15.

4914. "Electric arc lamps." H. J. HADDAN. (Communicated by E. Boettcher.) Dated October 16.

4926. "Improved means for transmitting electrical impulses to a distance, especially applicable to submarine telegraphy." A. W. L. REDDIE. (Communicated by La Société Universelle d'Electricité Tommassi." Dated October 16.

4932. "Means or apparatus for obtaining heat and motive power from electricity." J. H. JOHNSON. (Communicated by H. de M. de Ballore.) Dated October 16.

4945. "Conductors for electrical railways or tramways." W. SIEMENS, Kt. (Partly communicated by E. W. Siemens.) Dated October 17.

4947. "Apparatus for measuring electrical energy." W. SIEMENS, Kt. (Communicated by E. W. Siemens.) Dated October 17.

4955. "Electric bells." F. J. E. CLARKE. Dated October 17.

4961. "Apparatus for electrical heating. J. S. SELLON. Dated October 17.

4964. "Improvements in transmitting and reproducing sounds at a distance, and in apparatus employed therein." A. G. BROOKES. (Communicated by T. N. Vail.) *Complete.* Dated October 18.

4970. "Improvements in and relating to the laying of underground electric wires and in apparatus connected therewith." W. P. THOMPSON. (Communicated by J. F. Martin.) Dated October 18.

4990. "Galvanic batteries." C. G. V. HOLMES, S. H. EMMENS, F. E. Burke. Dated October 19.

5001. "Telegraphic insulators." H. J. ALLISON. (Communicated by C. C. Kinsdale.) Dated October 20.

5008. "Improvements in and relating to apparatus to be used in telephonic systems for putting any of the instruments connected with a central station into communication with each other." W. R. LAKE. (Communicated by H. T. Cedergren and L. M. Ericsson.) Dated October 20.

5024. "Printing telegraphs, transmitters and circuits therefor." H. J. ALLISON. (Communicated by S. D. Field.) Dated October 23.

5031. "Construction of electro-motors, dynamo or magneto machines." A. RECKENZAUN. Dated October 23.

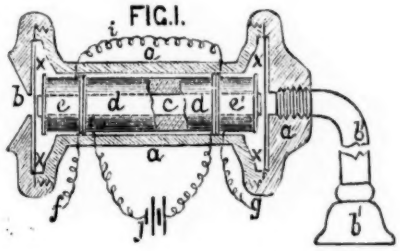
5036. "Apparatus for illumination and for the ignition of inflammable substances and gases by electrical discharge." O. E. WOODHOUSE, F. L. RAWSON, A. R. MOLISON. Dated October 23.

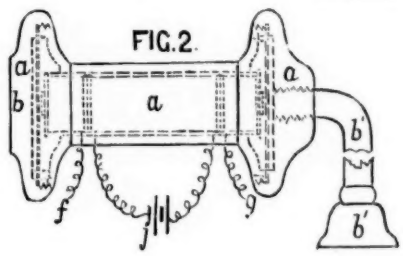
5042. "Electrical igniting apparatus for gas engines." W. R. LAKE. (Communicated by N. de Kabath.) Dated October 23.

5043. "Electrical accumulators applicable in part to regenerative primary batteries." W. P. THOMPSON. (Communicated by K. W. Zenger.) Dated October 23.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

339. "Telephonic apparatus." J. GRAHAM. Dated Jan. 20. 6d. The object of the invention is to afford increased facilities for the transmission and receiving of telephonic communications by means of electric telephonic apparatus with simplicity of construction and economy in manufacture of such apparatus. Fig. 1 shows a sectional view and fig. 2 an outside view of the instrument, in which *a* is the outer case or cover, *b* a mouth-piece for which may be substituted (especially when the instrument is used as a receiver), b^1 a flexible tube and end piece for speaking into or hearing for transmitting or receiving sounds, *x* x^1 are the flexible diaphragms, *c* is the soft iron core or magnetisable bar around which the bobbins or windings of wire, *d* and *e*, e^1 are placed. According to one arrangement, *d* is the coarse wire winding forming the local inducing coil and *e*, e^1 the fine wire windings forming the receiving or transmitting coils; *f* and *g* are the outer ends of the fine wire coils, one of which is connected to earth or loop, as the case may be, and the other to line *i* shows the inner ends of the fine wire coils joined together; *j* shows the coarse winding coil ends to be joined to a local inducing battery. According to another arrangement, the relative positions of the coarse and fine wire coils just described may be reversed, a single coil of fine wire taking the place of the coarse wire coil, and one end of this single fine wire coil is connected to loop or earth and the other to line, and two coarse wire coils taking the place of the fine wire coils, the inner ends of the coarse wire coils being connected together, and the outer ends thereof being joined to a local battery. For this purpose the inventor provides in the case of apparatus to be used as a transmitting instrument, an interior soft iron or other suitable core surrounded by an insulated winding of coarse wire, the two ends of this coarse wire coil being





during transmission brought in manner, such as is well understood, into electrical connection with a galvanic battery and removed from such connection when out of use. At each extremity of this coil of coarse wire and around the ends of the interior core is another coil of fine wire, the inner extremity of this fine wire of each coil being in electrical connection by wire or otherwise one with the other, and the outer extremity of the one fine wire coil being connected to line and the other end of the other to earth or loop, as the case may be. Opposite each end of the core is a suitable disc or diaphragm capable of being vibrated and of thereby inducing pulsations of current in the coils of fine wire which are transmitted in the usual manner to a receiving instrument. In the case of apparatus to be used a a receiving instrument, the parts are similarly constituted by an internal core of soft iron or other suitable core, surrounded by a coarse wire winding, suitably insulated and similarly connected to a galvanic battery as before described, and of a fine wire coil at each end of the coil of coarse wire, the inner end of each fine wire winding being electrically connected together, and their other fine wire ends being so connected one to line and the other to earth or loop, as the case may be. In this receiving instrument the pulsations of current transmitted to the fine wire coils cause those fine wire coils by their combined action greatly to vary the attraction of the core and cause the desired action upon the discs or diaphragms which are provided opposite each end of such core in position.

555. "Electrical conductors." J. IMRAY. (Communicated from abroad by the Société Anonyme des Cables Electriques (Système Berthoud Borel et Cie.), of Paris). Dated February 1. 4d. Relates to the construction of electrical conductors in such a manner that they are efficiently insulated, protected against damp and injury, and against interference by extraneous currents, whilst the sheathing which protects them is so arranged that the conducting wires or sets of wires are always retained in a central position, notwithstanding severe flexures or great changes of temperature. For this purpose, the wire or set of wires constituting the conductor is, in the first place covered with a layer of cotton or other suitable fibrous material, or with several layers thereof, and soaked in a bath at a temperature of 300° to 350° Fahr., consisting of the insulating material described in the Specification to Letters Patent dated March 29th, 1882, No. 1516, the soaking being continued until the fibrous covering is completely freed from moisture and impregnated with the insulating material.

The conductor thus covered is now covered with a sheath of lead by the method and apparatus described in the Specification to Letters Patent dated December 6th, 1880, No. 5083, but the lead sheath thus put on is passed through a notched matrix, so that three or more longitudinal ribs project a little from its general cylindrical surface. A second sheath of lead is now put on in the same way as the first, this second sheath having an internal diameter equivalent to the width across the ribs of the first, and consequently enclosing segmental spaces between the ribs, which spaces are filled in the sheathing process with pitch or other similar substance impermeable to moisture. Fig. 1 shows the

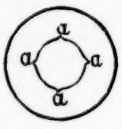


FIG. 1.

FIG. 2.

FIG. 3.

form of the matrix to be used in the apparatus described in the Specification No. 5083 of 1880 above referred to, for forming the lead casing with triangular ribs corresponding to the notches, *a*, of the matrix, of which there may be a less or greater number, according to the size of the conductor. Fig. 2 is a section of the conductor with its lead casing, *t*. presenting the ribs, *b*; and fig. 3 is a section of the same enclosed within another lead tube, the space between the two lead sheaths being filled in during the sheathing process with pitch, *c*, or with other impermeable material of like kind.

559. "Dynamo-electric machines." W. P. THOMPSON. (A communication from J. A. I. Craig of Canada.) Dated February 1. 6d. Has for its object to increase the efficiency of dynamo-electric machines by reducing the magnetic friction between the armature and the field, and thus economise power; and also to lessen the cost of the apparatus, while greatly increasing the electrical force, and at the same time produce a machine which can be easily taken apart for repairs and readily put together, without disturbing more than a few parts at one time.

592. "Galvanic batteries." P. R. DE FAUCHEUX D'HUMY. Dated February 3. 6d. Has for its object improvements in galvanic batteries, and relates to means whereby a battery of a given size is rendered much more powerful and effective than when constructed in the manner heretofore adopted. For this purpose, instead of forming the negative and positive elements of the battery of plain cylinders, blocks, plates or sheets of material exposing a minimum of surface to the exciting liquids, the inventor constructs such parts in such manner as to give them a greatly increased extent of surface. According to one arrangement he forms the said elements of fluted, corrugated, or perforated tubes or plates, or he forms the same of a top and bottom ring or bar connected together by rods or bars of round, angular, or other suitable section, or of combinations of rods of both round and other sections, and, if desired, twisted. If desired the lower bar or ring may be dispensed with. Or he forms such parts of woven wire, which may be either single or double; in the latter case he fills the intervening space with metallic oxide, turnings, borings, or other material which will increase the surface of the element exposed to the exciting liquid and assist the development of electricity.

594. "Telephones." G. H. BASSANO, A. E. SLATER, and F. T. HOLLINS. Dated February 3. 2d. The invention is designed to produce telephones in a simple and cheaper manner than heretofore, and capable of giving good results. The invention consists, firstly, in making the vibrating plate the pole piece of an electro-magnet, thus polarising the plate itself, and causing magnetic tension in the plate thus magnetised by placing before it a piece or pieces of suitable iron or steel, magnetic or non-magnetic.

598. "Galvanic Batteries." H. THAME. Dated February 3. 4d. The inventor takes an ordinary Bunsen element which he charges in the outer cell with the sulphuric acid solution. The porous cell within this he constructs with an upper rim or groove around the edge so that a cap or bell can stand within this groove and partially or wholly prevent escape of acid vapour, the groove being packed with sand and water, or water only, or other suitable packing. In the crown of the bell is a hole with packing of asbestos or other material through which passes the conductor from the carbon element. The liquid for charging the carbon cell does not consist wholly of the usual nitric acid but of the following proportions of that acid, which may be considerably varied, namely, nitric acid, 3 parts by volume and to which is added and in which consists the first and second parts of the invention, a proportion, *viz.*, to the above quantity of nitric acid 1 part by volume of the liquid known as chloro-chromic acid, or chloro-chromic anhydride, or oxychloride of chromium.

612. "Manufacture of covered wire for electrical purposes, &c." W. HALKYARD. Dated February 5. This invention has reference to the manufacture of covered wire or conductors for electrical purposes, and to machines or apparatus for providing the wire or conductors continuously with a metallic covering while the wire passes through the machine.

614. "Electric Generators." J. A. FLEMING. Dated February 5. 6d. Relates to the formation of primary galvanic batteries whereby greater constancy of current can be obtained and the internal resistance reduced, and it has reference to the formation of a primary galvanic battery, in which the positive electrode consists of a carbon block of coarsely cellular structure, or a cage or cages formed of carbon rods, or a cage or cages formed of sheets of carbon pierced with apertures filled with small carbon blocks, an oxidizing liquid being supplied to the interior of this structure cage or cages by a pipe or pipes, so as to rapidly depolarise the carbon, and to obtain a highly permeable carbon electrode without the use of a porous plate or septum of any kind of non-conducting material.

623. "Apparatus for measuring and regulating currents of electricity." P. CARDEW. Dated February 5. 6d. The inventor utilizes the heating effect of the current on a conductor or several conductors through which it is passed, this heating producing an extension of the conductor, the amount of which, being indicated by suitable apparatus, measures the amount of current passing.

624. "Electro-motors." W. R. LAKE. (Communicated from abroad by A. Skene and F. Kühmaier of Austria.) Dated February 5. 6d. Relates to electro-motors and comprises means for regulating the speed of such motors, a special system of winding the coils of the electro-magnets, and the employment of an adjustable commutator plate for the purpose of reversing the direction of motion of the said motor.

628. "Dynamo-electric or electro-dynamic machine. R. W. MUNRO. (Communicated from abroad by A. E. Swonnikoff of Paris.) Dated February 5. 2d. Relates to a form of dynamo-electric or electro-dynamic machine, whereby simplicity of construction and efficiency of action are obtained. (*Provisional only.*)

629. "Voltaic batteries." R. LARCHIN. (Communicated from abroad by L. Hartmann of St. Petersburgh.) Dated February 5. 2d. Relates to the construction of voltaic batteries and the preparation and application of their elements in such a manner as to render the electrical production very uniform over long periods of time. For this purpose zinc is employed as the positive element, and silver as the negative element, the silver being immersed in a solution of caustic potash, or soda, is employed as the exciting liquid. The zinc occupies the middle of each cell, and may be surrounded by a porous partition, the silver being at the sides, not in one plate or mass, but in a subdivided form, so as to present, in comparatively small space, a large amount of surface with numerous interstices for escape of the hydrogen. (*Provisional only.*)

631. "Electric lighting apparatus for railway and other carriages." A. M. CLARK. (Communicated from abroad by N. de Kabath, of Paris.) Dated February 5. 6d. Relates to improvements in apparatus for and connected with the electric lighting of railway and other carriages, and the invention comprises a self-contained electric lamp; combining in itself an independent store of electric energy and station charging apparatus for re-charging the lamps when exhausted. The object in view is to utilise, as far as possible, the fittings now used in the existing rolling stock, which is essential to an economical installation of the light, and to this end the inventor utilises the existing oil lamps of each compartment of the carriages by substituting for the oil-reservoir accumulators independent of those of the lamps in the other compartments or carriages, so that a carriage may be detached from a train and still remain lighted as by the oil lamps now in use, whilst by merely turning a key or commutator any one of the lamps may be extinguished even more easily

FIG.1.

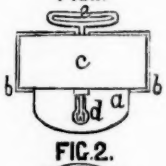


FIG.2.

than an oil lamp, and without affecting the remainder of the lamps in the other compartments. Figs. 1 and 2 represent the improved electric lamp which is described first. Around the opening in the roof of the carriage is provided an insulated seating for the electric lamp, the illuminating portion of which descends into the ordinary glass bowl, *a*. The lamp is provided with two conducting strips of copper attached to a cellular box *c*, containing a group of accumulators connected in tension, their number depending on the distance between the charging stations and the intended duration of the lighting. Beneath this vessel is an ordinary incandescence lamp, *d*, connected to the two poles of the accumulator placed immediately above, by copper wires. The current may be easily established or interrupted by means of a commutator, *e*, formed like a key handle placed directly above the box, so as to serve also as a handle for carrying the lamp about.

632. "Storage batteries or electric accumulators." J. H. JOHNSON. (Communicated from J. A. Maloney of America.)

Dated February 6. 2d. According to this invention a battery jar is provided, formed of any insulating material, containing a porous plate, formed of black oxide of manganese, and a second plate formed of carbon, the said plates having connections with binding posts attached to the cover. The liquid into which these plates are submerged consists of dilute sulphuric acid, containing an ammoniacal salt or other ammoniacal compound in solution, or water with an ammoniacal salt or other ammoniacal compound in solution. *(Provisional only.)*

633. "Manufacture of finely divided lead, lead alloys, and compounds of the same, for use in secondary batteries, &c." W. CROSS. Dated February 6. 4d. In carrying the invention into practice the inventor takes any suitable quantity of lead and subjects the same, in any suitable furnace, vessel or apparatus, to such a temperature that it assumes a molten, or liquid, semi-liquid, or vicious *(sic)* state, and while in this condition the inventor causes it to pass or flow through an opening or openings of any suitable form and dimensions into any suitable vessel or chamber, and while it is thus passing he causes to act upon it in any suitable manner and by any suitable apparatus a blast or blasts, jets, or currents of any suitable liquid or gaseous fluid or fluids; for example, air, nitrogen, carbonic oxide, carbonic anhydride, hydro-carbons in a gaseous or liquid condition, steam, water, or other liquid or gaseous bodies, which may be used alone or in combination with each other. By this means the liquid, semi-liquid, or vicious lead is broken up and separated into a finely divided condition.

634. "Apparatus for regulating electric lamps, electric currents, electric potentials, &c." A. GRAY and T. GRAY. Dated February 6. 2d. Consists principally of a continuous endless motor in combination with governing apparatus, which may, for example, be an air fly or a set of vanes turning in a liquid, or a friction governor, or any other suitable and convenient form of governing appliance. *(Provisional only.)*

639. "Electric lamps." J. G. LORRAIN. Dated February 6. 6d. Relates to electric arc lamps of the type in respect of which the inventor obtained Letters Patent, dated July 27th, 1882, No. 3,575, and consists in improvements in the same.

CORRESPONDENCE.

Electric Lighting Powers.

The remarks in your issue of the 13th inst. on the action of the Board of Trade in connection with the Jablochkoff Company's application for a license to light the Strand district seem to me to place matters before your readers from a one-sided point of view. This may have its origin in your outspoken enmity to the granting of provisional orders generally, for whenever you have had occasion to refer to the provisions of the Electric Lighting Act you have advocated the system of licenses. It appears natural, therefore, that you feel compassion with the defeated Jablochkoff Company. But it is doubtful what service can be rendered to the shareholders by this hard and undeserved criticism of the Board of Trade. The provisional orders promoted by the Swan and Edison Companies passed through Parliament after careful inquiry by two Parliamentary Committees. Are these orders not in entire conformity with the meaning of the Act, and is it not usual when powers are sought by two opposed parties, to pass that application which seeks the widest powers? And are not nearly all electric light companies in accord that it cannot pay to work under a license for seven years? The Jablochkoff Company, it is true, for one reason or another, which is as yet unexplained, have preferred the license, very likely because they were not prepared to take upon themselves the risk of a large installation for house lighting, and they, in alliance with the Strand District Board of Works, expected that they could carry on a successful campaign against rival companies, who, however, by reason of their experience, were better qualified to do the work of house lighting.

Too much has already been written about the Board of Trade overriding the wishes of a local authority, and about the alleged fear of a monopoly being given to companies in the shape of a provisional order.

I, for one, believe that electric lighting on a large scale will practically be impossible without such a monopoly, and as for the interpretation of the Act that local authorities are to have preference before private companies, it can apply to those cases only, where the local authority applies for a license or order in its own name and responsibility, as has actually been done by several provincial towns and one vestry in the metropolis.

Trusting you will find space in your columns for these few remarks.

Impartial Critic.

Oct. 17th, 1883.

The Generation of Electricity by means of Wind and Water Power.

THE idea which Sir William Siemens conceived some years ago, of the immense amount of electricity which the Falls of Niagara might be made to generate in North America, has already borne practical fruit in the Portrush Electrical Railway, and not only there, but in several places in England, water power is being used to work dynamos.

Cannot the powerful agency of water be more generally utilised throughout the United Kingdom, and a system of turbines arranged, to take advantage of the force of water, which is now being wasted?

As a beginning, surely experiments might be made in such rivers as the Thames, the Avon at Bristol, and the Mersey, and in harbours such as Portsmouth and Hamoaze, where the rush of water is enormous.

I believe the time will come when every village stream will be turned to account for this purpose and made to do useful work, and indeed eventually the water companies may be able to assist the electrical companies by means of valves and turbines connected with their reservoirs.

Now, besides water, there is another great natural force of which, in these islands, we have an abundant supply, namely, wind, which, either separately or in conjunction with water power, might be used as an economical generator of electricity.

Wind-mills, like water-mills, are of ancient origin, and until the steam-engine became universal, were much used in England. For the past forty or fifty years steam has been the most general motive power, but towards the close of the 19th century it seems probable that wind power will again be more freely resorted to.

I think that, at all events, round our coast, and on exposed positions, during nearly 250 days out of the year, there will be a sufficient force of wind to work dynamo machines, and during the 100 and odd days of calms and light airs, which would certainly not all be consecutive, we have accumulators or secondary batteries, such as those which Messrs. Faure-Sellon-Volckmar & Co. are improving so rapidly, to aid us.

Instead of the old-fashioned wind-mill sails, improved air fans might be used to advantage, and in these days of mechanical ingenuity there would be, I imagine, little difficulty in obtaining suitable machinery for the purpose.

At present the chief obstacle to the more extended use of the electric light is its costliness, steam power being generally employed to work the dynamo machines for the generation of electric energy, and by lessening the expense of production, through the utilisation of natural forces, one of the principal drawbacks to its complete success would be surmounted.

In the incandescent lamp we have a light suitable on all points for domestic illumination, as being hermetically sealed, it does not exhaust the oxygen in the air, and the amount of heat thrown off by its glass bulb is very trifling. Moreover, it does no damage to decorations, pictures, &c., and its light is quite steady.

It must also be remembered that, once having the electric current "laid on," so to speak, to our houses, it may be usefully employed in a variety of other ways.

Taking, then, these two powerful forces, namely, water and wind, using them as auxiliaries one to the other, I hope the day is not far distant when not only will every stream and rivulet, but every small hill and elevated position, be pressed into the service of the surrounding districts to supply the power needed for local manufactures and domestic convenience.

Douglas M. Forsyth,
Commander, R.N.

Ryde, *October 16th*, 1883.

Telephone Patents.

Patent No. 2,322. 8th May, 1883. Issued to C. W. Hayes and Seth R. Beckwith, in a communication from Mysore L. Baxter, of the United States.

The title of this patent is "*Transmitting and Receiving Telephones.*"

The transmitting instrument is described in the following words:—"The diaphragm is surrounded at its periphery by a soft rubber binding, and is held in its position by the clip; from the centre of the diaphragm projects a metallic stud, in suitable contact with a carbon button, which is fastened to a swinging bar. One pole of the battery is connected to the metallic stud on the diaphragm, and the other pole to the carbon button."

1st claim. "The combination of the suspended bar carrying one of the electrodes attached to the adjusting devices, with the vibrating diaphragm carrying the attendant rod."

2nd claim. "The vibrating diaphragm carrying one of the electrodes in combination with the suspended bar, and the bolt carrying the other electrode and the check nut, as and for the purposes specified."

This arrangement is clearly the combination of a diaphragm with a tension regulator, the special arrangement of the parts differing very slightly from the description in Edison's patent of 1877, No. 2,909, but it resembles more nearly the arrangement described in Blake's patent, No. 229, of 1879.

In the case of the United Telephone Company against Harrison, Cox-Walker, Mr. Justice Fry said: "The true meaning of the second claim in Edison's patent is the union of a tympan or diaphragm capable of vibrating under the sound waves with an electric tension regulator," the claim in Edison's patent being "for an instrument for transmitting electrical impulses by sound, the combination with a diaphragm or tympan of electric tension regulators, substantially as hereinbefore described."

* * * * *

The Baxter receiving instrument is described in the specification.

"A stock or holder made of wood, hard rubber, or other suitable material, with ear-piece attached in any convenient manner for clamping and securely holding by its periphery the vibrating iron diaphragm, and a U-shaped permanent magnet, to one leg of which the aforesaid diaphragm is attached by a screw."

The 5th claim is: "In combination with an iron diaphragm, arranged at right angles, and in proximity to one pole of a permanent magnet, said magnet exciting an attractive influence at or near its centre; an inducing coil for varying said attraction composed partly of copper and partly of iron for the purpose specified."

Here then we have an iron diaphragm clamped around its edges, the centre of which is over the pole of a magnet.

Mr. Justice Fry in his judgment in the case above referred to used these words: "I think it expedient to describe Bell's receiver as claimed by him and as I understand it. It consists of a horse-shoe magnet, the ends of which are brought into the circuit by means of coils of wire, and in front of which is a metallic plate, capable of inductive action, resting, as regards its circumference, on the wooden case."

The late Sir George Jessel, Master of the Rolls, in the appeal case said: "The specification of Bell's patent tells us there is a thin plate or disc in front of the magnet, close to the magnet, fixed or attached, and in such a way as to keep the whole circumference fixed."

* * * * *

Common Sense.

Oct. 21*st*, 1883.

[Where the asterisks are placed our correspondent had expressed decided opinions on the value of this patent which we did not feel justified in publishing.—EDS. ELEC. REV.]

Electric Launches.

A friend of mine has seen on the river Thames, and had occasion to inspect, a so-called electric boat . . . . . which I have seen advertised several times. . . . . He finds that the power is obtained from badly-constructed bichromate batteries, and that the motor is so made as to give at the highest computation an efficiency of only 20 per cent., which would certainly be excelled by the primitive motor made by Jacobi in 1839.

I write the above in the interests of our profession, as there is no doubt that it is work of this description, both in the application of electricity to light and motive power, that has done so much harm to electrical science in the eyes of the general public.

I hope that in manufacturing more of these boats the makers will at least use an efficient motor.

Alfred Lawrence.

5, Clissold Road, Stoke Newington,
October 23*rd*, 1883.

"A Novel Way to Connect a Telephone."

If your readers will refer to Specification 3,661, 1882 (English patents), it will be seen that there is nothing new in what J. W. Lattig claims as a novelty in connecting up a telephone circuit. In the same Specification a novel way of constructing an induction coil, with advantage, is claimed.

Semper Veritas.

Manchester, *October* 23*rd*, 1883.

Photographing the Vibrations of the Voice.

Seeing several notices in your paper of a telephone patented by Mr. St. George, in which he includes apparatus for the recording of speech by means of photography, I shall be glad if you can find room in your paper for the following extract from the *Scientific American*, June 18th, 1881, which contains a description and drawings of apparatus used by me for the same purpose 2½ years ago.

"PHOTOGRAPHING THE VIBRATIONS OF THE VOICE.
"By C. CUTTRISS.

"Reading of experiments of Messrs. Bell and Tainter on the photophone, the idea struck me that the vibrations of the voice might be photographed. Not having the facilities to carry out the experiments, I communicated the idea, with a sketch, to my brother, Thomas Cuttriss, Leeds, who has carried it out as follows:—A box, blacked inside, has a shelf, on which slides a saddle, B, which carries the plate, E, and shaft, D, by which the plate is rotated. C is a silk thread fastened at one end to the shelf, the other being wrapped round the shaft, D, in that way, when the shaft is turned, traversing the plate in front of the slit, F, and the movable shutter, G. The shutter is connected to the diaphragm, H, by the wire, I, and is opened and closed by the vibrations of the diaphragm. A powerful light is focussed upon the slit (sunlight was used in our experiments), and the plate rotated as steadily as possible while speaking upon the diaphragm.

"The plate, on being developed, showed a spiral, across which were dark lines showing on the outer circles the vibrations of the diaphragm very distinctly (see fig. 3); but owing to the much slower speed of the plate, as it drew nearer the centre the vibrations there merged into a dense fog and were lost.

"The vibrations are similar to the indents on the tinfoil of Edison's phonograph.

"We are now trying to reproduce the words by the action of light transmitted through the negative upon a gelatine film, using that in like manner to the tinfoil in the phonograph. The plate used was an ordinary wet negative."

P.S.—The letters refer to drawings which it is scarcely necessary to reproduce here.

Thos. Cuttriss.

72, New Briggate, Leeds,
October 23*rd*, 1883.